Appendix A.

Cache Creek, Bear Creek, and Harley Gulch TMDL for Mercury Staff Report November 2004

This report is available on the website of the Central Valley Regional Water Quality Control Board at:

http://www.waterboards.ca.gov/centralvalley/programs/tmdl/Cache-SulphurCreek/index.html

Appendix B

Sulphur Creek TMDL for Mercury Staff Report
August 2004

This report is available on the website of the Central Valley Regional Water Quality Control Board at:

http://www.waterboards.ca.gov/centralvalley/programs/tmdl/Cache-SulphurCreek/index.html

APPENDIX C. ANDERSON MARSH METHYLMERCURY SAMPLES

Anderson Marsh State Historic Park is located at the outlet of Clear Lake and three miles upstream from the Clear Lake Dam. The 1,000-acre park contains oak woodlands, cottonwood lined riparian areas, and a tule wetland. Regional Board staff is currently collecting water quality samples to determine if the wetland methylates mercury that results in high methylmercury concentrations at the Clear Lake Dam. Figure C-1 shows Regional Board sampling sites and Table C-1 lists methylmercury samples collected.

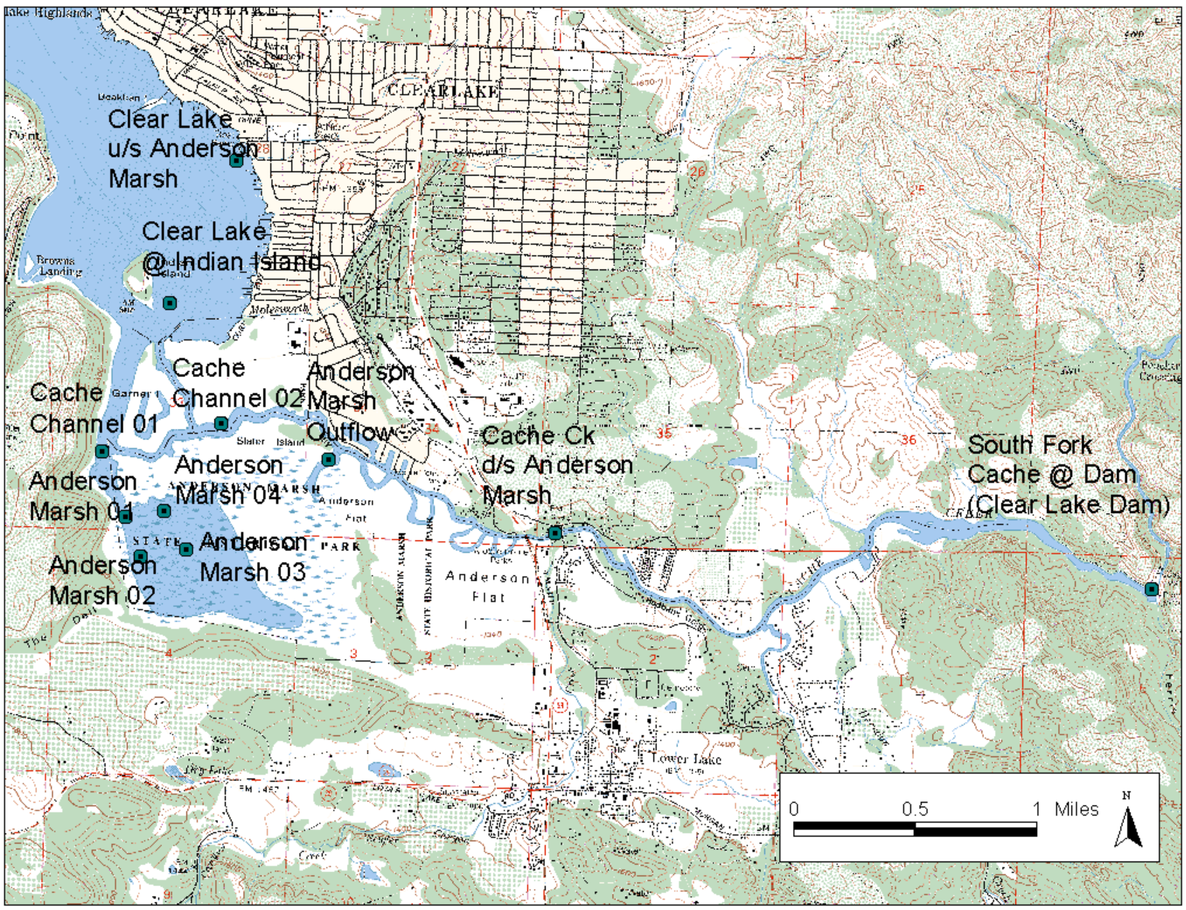

Figure C-1. Anderson Marsh Sample Sites

Table C-1. Anderson Marsh Methylmercury Samples

Site Name	Latitude	Longitude	Methylmercury Concentrations (ng/L)			
			06/09/04	08/03/04	08/25/04	09/22/04
Clear Lake u/s Anderson Marsh	38.94724	122.63626	0.046	0.18	0.08	0.06
Clear Lake at Indian Island	38.93814	122.64242			0.08	
Cache Channel 01	38.92969	122.64656			0.12	
Cache Channel 02	38.93161	122.63692			0.09	0.10
Anderson Marsh 01	38.92581	122.64531			0.12	
Anderson Marsh 02	38.92389	122.64367			0.15	
Anderson Marsh 03	38.92436	122.64033			0.18	
Anderson Marsh 04	38.92622	122.64244			0.19	
Anderson Marsh Outflow	38.92914	122.63036			0.41	0.45
Cache Creek d/s Anderson Marsh[a]	38.92550	122.61163	0.22	0.25	0.18	0.10
South Fork Cache Ck at Dam (Clear Lake Dam)	38.92328	122.56553	0.23	0.34	0.16	0.10

(a) Cache Creek d/s Anderson Marsh sample was collected upstream of the regular site at 38.92656 and 122.62056 on August 25, 2004

Appendix D. Cache Creek Watershed Sediment Data

D.1 Determination of Regional Background Sediment Concentration

A major goal of the proposed Implementation Plan is to decrease the concentration of mercury in creek sediment in order to reduce methylmercury production. Toward this goal, Regional Board staff evaluated sediment and soil concentration data from multiple sources to determine the range of sediment mercury concentrations. These sources are copied or summarized below.

Concentrations of mercury in sediment in the Cache Creek watershed span a wide range. The data indicate that outside of areas containing inactive mines, mine waste, or springs, there is a relatively consistent, low level of mercury in fine-grained soil and sediment. Regional Board staff termed this low level the "regional background concentration". The implementation plan seeks to control soils containing mercury above the regional background concentration from entering the creeks. Justification for this approach comes from field and laboratory data showing a direct, positive correlation between concentration of total mercury in surficial sediment and methylmercury production (See Chapter 4 Cache Creek TMDL report). The most effective management practice available now to reduce the concentration of methylmercury in Cache Creek is to reduce the concentration of mercury in sediment.

Data sources and summary

A. Fine Grained Sediment/Soil data

Regional Board Sediment Sampling Data

In September and December 2004, Regional Board staff walked the Cache Creek canyon collecting samples of surficial sediment. Samples were collected on shallow terraces in Cache Creek (3-10 feet above low level of creek, assumed within the area inundated in winter storm flows) and from the sediment at the mouths of Cache Creek tributaries. Data are provided in this Appendix. Sample collection and preparation followed the CALFED mercury project QAPP. Sediment samples were separated into three size fractions: fine (<63 microns), medium (between 63 microns and 1 millimeter) and coarse (1 to 2.8 millimeters). Data was collected in the Cache Creek canyon from upstream of Harley Gulch to the confluence of Bear Creek with Cache Creek. Samples of fine-grained sediment in the watershed below Rumsey have not been collected. Data and map follow in this appendix.

CDFG, 2004. Data Collection for Harley Gulch TMDL

In September 2003, staff from the California Department of Fish and Game Moss Landing Marine Laboratory and the Regional Board collected sediment and soil samples from the main stem and tributaries (including the East and West Branches) Harley Gulch and several nearby tributaries of North Fork Cache Creek. Sample collection and preparation followed the CALFED mercury project QAPP. Data for the fine-grained (<63 micron) fraction were reported. Data and map follow in this appendix. Data from the North Fork Cache Creek tributaries (five samples in range of 0.05-0.24 mg/kg mercury, one sample with 1.6 mg/kg) are informative in identifying a regional background concentration.

B. Bulk Sediment/Soil Data.

Churchill and Clinkenbeard, 2004. CALFED Mercury Project

Churchill and Clinkenbeard measured mercury in soil collected from areas outside of the Sulphur Creek Mining District. The average concentration of regional background soil was 0.19 mg/kg (range 0.07-0.31 mg/kg, N = 11). The samples were collected to in order to evaluate erosive material. Therefore, large clods and rocks were omitted from the sample by the collector, but the sample was not sieved before analysis. Data are reported for the entire (bulk) sample. These data support the regional background number but may not be directly comparable to the fine-grained sediment data. Data available at: http://loer.tamug.tamu.edu/calfed/FinalReports.htm.

Pearcy and Peterson, 1990. Journal of Geochemical Exploration 36:143-169
In the 1980s, the Homestake Mining Company collected surficial and subsurface rock and soil samples from a grid of 94 holes in the lower Sulphur Creek mine area (includes West End, Central, Manzanita, Empire, Cherry Hill, and Wide Awake sites). Data are reported for the entire (bulk) sample. Outside the halo of mineral deposition, soil concentrations were 0.2 mg/kg mercury.

C. Mercury in Suspended Sediment data
Regional Board also has data on concentrations of mercury in suspended sediment in mg/kg dry weight. (Hg/TSS; defined as the ratio of aqueous mercury concentration, unfiltered to concentration of total suspended solids). Hg/TSS ratios for a given water body may tend to be higher than the concentration of mercury in fine-grained sediment from the same water body. For example, concentrations of mercury in fine-grained sediment collected from tributaries in the North Fork Cache Creek are all below 0.2 mg/kg (see data this appendix), whereas the median Hg/TSS concentration is 0.27 mg/kg (See Cache TMDL report). Although perhaps not fully comparable with fine-grained sediment data, the more geographically extensive data set of Hg/TSS data demonstrates mercury contamination in Cache Creek from downstream of the mined areas through the Settling Basin.

Cache Creek TMDL Report and Foe and Croyle, 1998.
The following two tables were provided in the Source Analysis section of the Cache Creek TMDL Report as Tables 3.11 and 3.12.

Table D-1 Five-Year Mercury to Suspended Sediment Ratio for Monitoring Locations in the Cache Creek Drainage.

	Cache Creek: Cache Creek Dam to North Fork	North Fork Cache Creek	Harley Gulch	Davis Creek	Bear Creek @ confluence w/ Cache	Cache Creek at Rumsey	Cache Creek at Yolo
Hg/TSS Ratio (mg/kg)	0.2	0.2	350	2.0	2.5	1.0	0.5

Table D-1 is a summary of Hg/TSS concentrations as an average of 5-year estimates of mercury and TSS loads. The ratio is low above the mine areas (Clear Lake and North Fork Cache Creek). Tributaries with mines and/or springs have high Hg/TSS ratios. The concentration at Yolo is half that at Rumsey, presumably because of dilution from inputs of sediment in the lower watershed with lower concentrations of mercury. The output at Yolo is still enriched, relative to the sites upstream of mine areas.

Table D-2 Median Mercury to Suspended Sediment Ratios for Tributaries in Cache Creek and Bear Creek.

Water body	Watershed Area (Sq. Miles)	Median Hg/TSS Ratio[a] (ppm)	Sample Size
North Fork Cache Creek			
Chalk Mt.	4	0.3	3
Wolf Creek	18.7	0.1	2
Long Valley	37.6	0.1	2
Benmore Canyon	7.4	0.2	2
Grizzly Creek	8	0.2	2
North Fork Cache Creek	197	0.3	26
Cache Creek: Clear Lake to North Fork			
Cache Creek Dam Outflow		0.3	20
Cache Creek at confluence with North Fork	14.8	0.2	3
Cache Creek Canyon (a)			
Stemple Creek	2.6	0.2	2
Rocky Creek	14.8	0.3	2
Judge Davis Creek (b)	2.4	1.4	2
Bushy Creek (b)	3.1	2.2	2
Petrified Canyon (b)	1.3	4.4	2
Trout Creek (b)	2.9	2.7	2
Crack Canyon	3.4	0.6	2
Bear Creek			
Upper Bear Creek at Bear Valley Rd	48.2	0.6	15
Bear Creek upstream of Sulphur Creek	58.6	0.6	4
Sulphur Creek	10.1	17.1	19
Bear Creek at Hwy 20	75.0	6.0	17
Lower Cache Creek (a)			
Rumsey Canyon	1.1	0.2	1
Johnson Canyon	3.9	0.5	1
Cross-Hamilton	12.9	0.2	1
Angus-Black Mt.	11.1	0.2	1
McKinney-Smith	9.3	0.2	1
Mossy Creek	14.5	0.1	1
Taylor-Chimney	24.3	0.1	1

(a) Data from Foe and Croyle, 1998, Tables 13-15.
(b) TSS concentration in samples from these tributaries was less than 5 mg/L. The Hg/TSS ratio in samples with very low TSS may be biased high, as a high concentration of Hg on a small particle of sediment or algae can skew the ratio.

Table D-3. Mercury in Sediment Samples collected by Regional Board staff in September 2004. Cache Creek Canyon samples collected between Harley Gulch and Bear Creek.

Site Code	Site Name	Latitude	Longitude	Sediment Concentration (ppm)		
				Fine (<63 um)	Medium (63 um – 1 mm)	Coarse (1 – 2.8 mm)
NF04	North Fork Cache Ck u/s Wolf Creek	39.06953	-122.58406	0.1	0.131	0.134
WC	Wolf Creek	39.06911	-122.58528	0.0	0.018	0.159
LV	Long Valley Creek	39.04822	-122.58072	0.0	<0.011 (ND)	<0.011 (ND)
HH	Hog Hollow Creek	39.02694	-122.57739	0.1	0.021	0.018
SH	Sweet Hollow Creek	39.01786	-122.57186	0.1	0.029	0.049
NF03	North Fork Cache Ck d/s Grizzly Creek	38.98767	-122.53883	0.0	0.069	0.088
NF02	North Fork Cache Ck	38.98447	-122.51469	0.0	0.022	0.125
NF01	North Fork Cache u/s South Fork Confluence	38.98097	-122.50511	0.0	0.032	0.028
SF	South Fork Cache u/s North Fork Confluence	38.98000	-122.50344	0.1	0.044	
CC01	Mainstem Cache Creek 1	38.98372	-122.49419	0.0	0.584	0.05
CC02	Mainstem Cache Creek 2 (u/s Stemple Ck)	38.98531	-122.48386	0.0	0.034	0.027
CC03	Mainstem Cache Creek 3 (d/s Stemple Ck)	38.98800	-122.48361	0.1	0.041	0.059
CC04	Mainstem Cache Creek 4 (Between Judge & Jack)	38.96483	-122.46717	1.25	0.82	0.71
CC05	Mainstem Cache Creek 5 (Between Judge & Jack)	38.96381	-122.46778	0.45	1.43	0.40
CC06	Mainstem Cache Creek 6 (Upper sandbar u/s Judge)	38.96164	-122.46192	0.50	0.54	0.46
CC07	Mainstem Cache Creek 7 (Sandbar u/s Judge)	38.96131	-122.45989	0.29	0.64	0.26
CC08	Mainstem Cache Creek 8	38.94601	-122.44547	0.86	1.12	1.44
CC09	Mainstem Cache Creek 9	38.94607	-122.44527	1.75	2.09	2.69
CC10	Mainstem Cache Creek 10	38.94564	-122.44463	0.75	0.52	0.15
CC11	Mainstem Cache Creek 11	38.94316	-122.44029	0.16	0.24	0.27
CC12	Mainstem Cache Creek 12	38.94309	-122.44003	1.45	1.16	2.84
CC13	Mainstem Cache Creek 13	38.94285	-122.43841	0.33	0.67	0.31
CC14	Mainstem Cache Creek 14	38.94410	-122.43597	0.47	1.23	4.75
CC15	Mainstem Cache Creek 15	38.94448	-122.43566	1.17	0.23	0.61
CC16	Mainstem Cache Creek 16	38.94458	-122.43393	0.52	0.29	0.30
CC17	Mainstem Cache Creek 17 (Kennedy Flat)	38.94753	-122.41992	0.48	0.49	0.75
CC18	Mainstem Cache Creek 18 (Kennedy Flat)	38.94797	-122.41975	0.49	0.67	0.44
CC19	Mainstem Cache Creek 19 (Kennedy Flat)	38.94822	-122.41947	0.34	0.74	0.41
CC20	Mainstem Cache Creek 20	38.94567	-122.41578	1.01	3.34	0.46
CC21	Mainstem Cache Creek 21	38.94531	-122.41611	3.58	0.76	0.93
CC22	Mainstem Cache Creek 22	38.94497	-122.41528	0.46	0.34	0.32
CC23	Mainstem Cache Creek 23	38.93994	-122.39439	1.11	0.33	0.29
CC24	Mainstem Cache Creek 24	38.93983	-122.39417	0.88	0.45	
CC25	Mainstem Cache Creek 25	38.93969	-122.39344	0.36	0.46	0.46
CC26	Mainstem Cache Creek 26	38.94381	-122.39042	0.25	0.41	0.30
CC27	Mainstem Cache Creek 27	38.94381	-122.39042	1.56	0.38	0.41
CC28	Mainstem Cache Creek 28	38.94414	-122.39078	0.82	0.42	0.35
CC29	Mainstem Cache Creek 29 (u/s Davis Creek)	38.94067	-122.38547	0.68	0.70	0.46
CC30	Mainstem Cache Creek 30 (u/s Davis Creek)	38.94047	-122.38514	0.38	0.40	0.29
CC31	Mainstem Cache Creek 31 (u/s Davis Creek)	38.94033	-122.38456	1.19	1.11	0.47
Site Code	Site Name	Latitude	Longitude	Sediment Concentration (ppm)		

				Fine (<63 um)	Medium (63 um – 1 mm)	Coarse (1 – 2.8 mm)
CC32	Mainstem Cache Creek 32 (d/s Davis Creek)	38.93056	-122.37040	1.15	1.77	1.06
CC33	Mainstem Cache Creek 33 (d/s Davis Creek)	38.92441	-122.37208	0.23	1.04	1.33
CC34	Mainstem Cache Creek 34 (d/s Davis Creek)	38.92454	-122.37073	0.17	1.27	1.50
CC35	Mainstem Cache Creek 35	38.92458	-122.36916	0.92	1.27	3.76
CC36	Mainstem Cache Creek 36	38.92268	-122.36421	0.49	1.53	2.52
CC37	Mainstem Cache Creek 37	38.92184	-122.36396	0.75	2.13	2.05
CC38	Mainstem Cache Creek 38	38.92077	-122.36266	0.33	2.16	0.21
CC39	Mainstem Cache Creek 39	38.91951	-122.35356	4.56	1.92	0.27
CC40	Mainstem Cache Creek 40	38.91845	-122.34826	0.27	1.23	1.56
CC41	Mainstem Cache Creek 41	38.93042	-122.37029	11.20	1.28	2.21
CC42	Mainstem Cache Creek 42	38.92987	-122.36993	0.30	1.18	2.00
CC43	Mainstem Cache Creek 43	38.92632	-122.37333	10.05	1.86	0.71
CC44	Mainstem Cache Creek 44	38.92619	-122.37373	0.32	2.20	1.69
CC45	Mainstem Cache Creek 45	38.92581	-122.37429	1.73	2.79	4.20

Table D.4 Regional Board sampling of sediment in Cache Creek Canyon tributaries, Sept. and Dec. 2004.

		Mercury Concentrations (mg/kg)		
Station		**Sediment fraction Fine (<63 micron)**	**Sediment fraction Medium (63 micron to < 1mm)**	**Sediment fraction Coarse (> 1mm)**
Cache Ck tribs	Harley Gulch	1.33	1.07	1.17
Cache Ck tribs	Rocky Ck	0.13	0.15	0.05
Cache Ck tribs	Rocky Ck	0.06	0.05	0.60
Cache Ck tribs	Jack Ck	0.05	0.05	0.04
Cache Ck tribs	Jack Ck	0.08	0.07	0.07
Cache Ck tribs	Judge Davis Ck	0.61	0.19	0.13
Cache Ck tribs	Judge Davis Ck upstream	0.10	0.17	0.42
Cache Ck tribs	Brushy Ck at mouth	0.05	0.24	0.15
Cache Ck tribs	Brushy Ck upstream	0.03	0.25	0.13
Cache Ck tribs	Petrified Ck	0.09	0.06	0.08
Cache Ck tribs	Petrified Ck	0.09	0.08	0.09
Cache Ck tribs	Trout Ck	0.13	0.17	0.12
Cache Ck tribs	Trout Ck	0.16	0.11	0.13
Cache Ck tribs	Crack Canyon	0.18	0.28	0.27
Cache Ck tribs	Crack Canyon	0.15	0.37	0.40
Cache Ck tribs	Crack Canyon	0.23	0.56	0.43
Cache Ck tribs	Davis Creek	0.14	0.44	0.30
Cache Ck tribs	Davis Creek	1.70	0.46	0.33
Cache Ck tribs	Davis Creek	0.14	1.61	0.38

Table D-5 CDFG Harley Gulch and North Fork Cache Creek Data on Mercury in Fine-Grained Sediment
From: CDFG, 2004. Data and Quality Assurance Report for Harley Gulch TMDL

Location	**Mercury, mg/kg dry wt (a)**
North Fork Cache Creek tributaries	
Stemple Creek, sample 1	0.06
Stemple Creek, sample 2	0.06
Benmore Creek, sample 1	0.05
Benmore Creek, sample 2	1.6
Grizzley Creek, sample 1	0.24
Grizzley Creek, sample 2	0.06
Harley Gulch sites, downstream of Hwy 20 (b)	
Harley Gulch main channel, site 1	2.75
Harley Gulch main channel, site 2	10.05
Harley Gulch main channel, site 3	0.77
Harley Gulch main channel, site 4	9.25
Harley Gulch tributary 1	0.37
Harley Gulch tributary 2	0.16
Harley Gulch tributary 3	0.1
Harley Gulch tributary 4	<0.01
Harley Gulch sites, upstream of Hwy 20(c)	
Harley Gulch east branch site 1	0.31
Harley Gulch east branch site 2	0.14
Harley Gulch east branch site 3	0.06
Harley Gulch east branch site 4	1.5
Harley Gulch east branch site 5	0.19
Harley Gulch east branch site 6	1.93
Harley Gulch east branch site 7	0.07
Harley Gulch east branch site 8	0.71
Harley Gulch west branch site 1	0.58
Harley Gulch west branch site 2	0.59
Harley Gulch west branch site 3	2.91
Harley Gulch west branch site 4	6.73
Harley Gulch west branch site 5	88.1
Harley Gulch west branch site 6	>100
Harley Gulch west branch site 7	2.15
Harley Gulch west branch site 8	2.57

(a) Data for fine grained fraction of sediment (<63 micron)

(b) Main stem sites 1-4 are in the reach between the stream flow gauge (near Highway 20) and the confluence with Cache Creek. Site 4 is closest to Cache Creek

(c) Site number 1 is farthest upstream; site numbers increase to confluence with West Branch. Sites 1- 6 are north of Hwy 20. Site 7 and 8 are south of Hwy 20. East Branch may not be influenced by mine wastes, but is considered enriched.

(d) West Branch sites 1-3 are upstream of roads to Abbott Mine site. May not be upstream of all erosion from mine workings at top of ridge. Site 5 is downstream of the Abbott tailings piles. Sites 7 and 8 are downstream of the Turkey Run spring and runoff.

Figure 2: Harley Gulch west and east branch sample sites

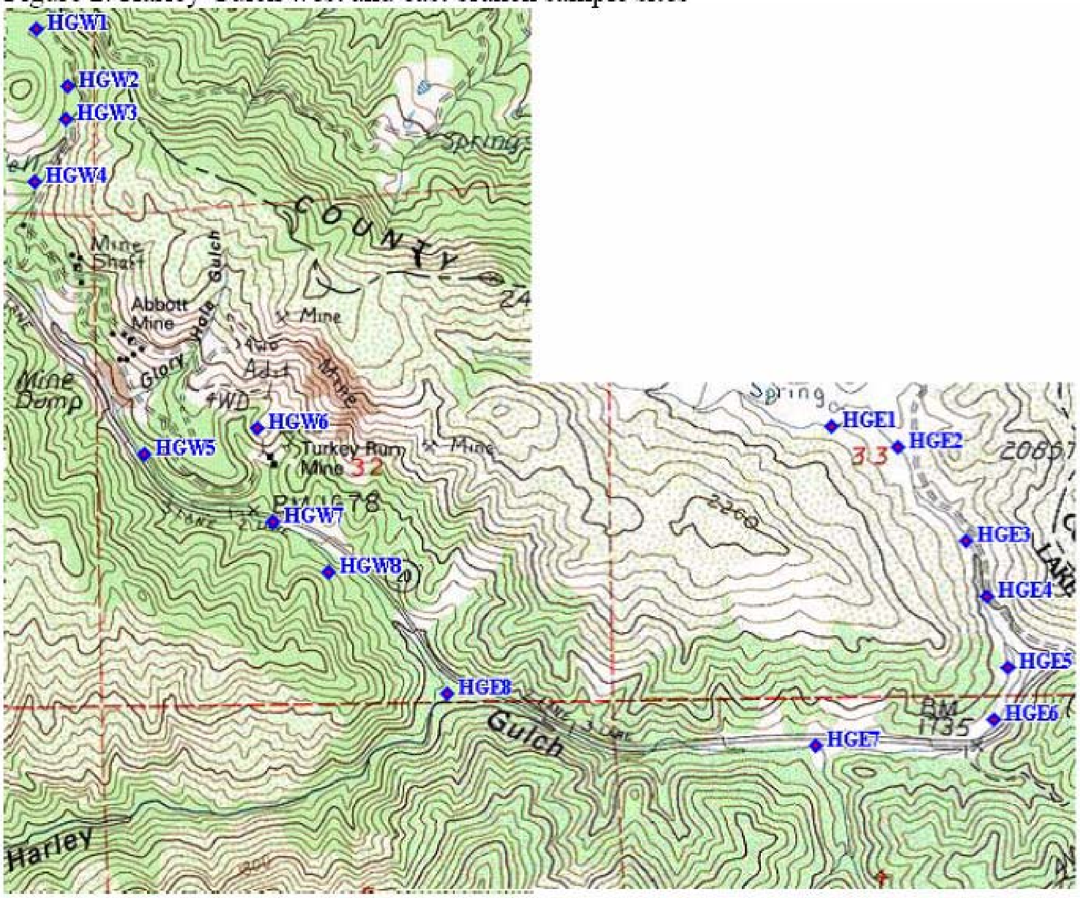

Figure D-1. Harley Gulch East and West Branch Sampling Sites. From CDFG, 2004

Appendix E. Calculation of Alternative 3 Water Quality Objectives

The following text details the calculation of the water quality objectives proposed in Alternative 3, which are based on the USEPA's Recommended Water Quality Criterion for Methylmercury for the Protection of Human Health (0.15 and 0.3 mg/kg, wet weight in Trophic Level 3 and 4 fish, respectively) for Cache Creek and Bear Creeks. Additional information on the development of fish tissue criteria is available in Section 2 of the Cache Creek, Bear Creek, and Harley Gulch TMDL for Mercury (Appendix A).

Alternative 3 proposes a water quality objective equivalent to USEPA's Recommended Water Quality Criterion for Methylmercury for Cache Creek and Bear Creek. To protect human health, the USEPA recommends an ambient water quality criterion for methylmercury of 0.3 mg/kg methylmercury in fish tissue, on a wet weight basis (USEPA, 2001a). The USEPA criterion represents the concentration in fish tissue that should not be exceeded based on a total consumption of locally caught fish of 17.5 g/day[1]. A level of 17.5 g/day is the consumption rate reported by the 90th percentile of participants in a 1994-96 nation-wide food survey conducted by the U.S. Department of Agriculture (including people who do not eat fish). The 17.5 g/day rate originated from the sum of particular amounts of fish from trophic levels 2, 3, and 4.

Other variables incorporated into the USEPA recommended criterion are an acceptable daily intake level of methylmercury (reference dose; RfD) of 0.1 micrograms/kg body weight/day and a standard adult body weight of 70 kg (NRC, 2000; USEPA, 2001a). The USEPA published this reference dose along with the recommended criterion in 2001. The reference dose was fully supported in an analysis of methylmercury data conducted by the National Research Council at the request of the U.S. Congress (NRC, 2000).

The USEPA criterion assumes consumers eat 12.5 g/day of fish obtained from commercial sources, in addition to the locally caught fish. USEPA estimates that the average methylmercury intake from eating 12.5g/day of commercial fish (mainly marine species) is 0.027 micrograms/kg bwt/day. The estimated intake of methylmercury from other sources, such as drinking water, other foods and air, is negligible (USEPA, 2001a). In order to calculate the fish tissue criterion for locally caught fish, the methylmercury dose from commercial fish was subtracted from the reference dose.

The USEPA recently published a recommended water quality criterion for the protection of human health (USEPA, 2001b). Variables incorporated into the USEPA recommended criterion are an acceptable daily intake level of methylmercury (reference dose; RfD) of 0.1 micrograms/kg body weight/day and a standard adult body weight of 70 kg. The USEPA published this reference dose along with the recommended criterion. The reference dose was fully supported in an analysis of methylmercury data conducted by the National Research Council at the request of the U.S. Congress (NRC, 2000).

The following equation was used for calculation of USEPA's recommended fish-tissue based methylmercury water quality criterion (USEPA, 2001b):

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1 17.5 g/day is equivalent to one eight-ounce meal per 2-week period, or four ounces per week (2.3 meals/month). 12.5 g/day is equivalent to 1.7 eight-ounce meals per month.

Equation 1

$$\frac{(\text{RfD} - \text{intake from other sources}) * \text{body weight}}{(CR_{TL2*} + CR_{TL3} + CR_{TL4})} = \text{Acceptable level of mercury in fish}$$

Where: RfD = reference dose for humans, representing the safe, total daily intake of methylmercury (0.1 micrograms/kg body weight per day).

Intake from other sources = average intake of methylmercury from marine fish by adults in the general population, as reported in the USDA 1994-96 nationally based Continuing Survey of Food Intake for Individuals (CSFII). The average intake from marine fish is 0.027 micrograms/kg bodyweight per day. (USEPA, 2000b). Other sources of methylmercury such as drinking water provide negligible quantities (USEPA, 2001b).

CRTL2 = consumption rate of fish from Trophic Level 2 (3.8 g/day)

CRTL3 = consumption rate of fish from Trophic Level 3 (8.0 g/day)

CRTL4 = consumption rate of fish from Trophic Level 4 (5.7 g/day)

The total of these consumption rates, 17.5 g/day, is the 90th percentile consumption rate reported in the USDA 1994-96 CFSII. This was a nationwide survey of the general population of the United States. Consumption rate data include people who do not eat fish or shellfish (USEPA, 2000b).

Application of USEPA's reference dose and default consumption rates to the above equation:

$$\frac{(0.10\ \mu g/kg\ day - 0.027\ \mu g/kg\ day) * 70\ kg}{(3.8\ g/day + 8.0\ g/day + 5.7\ g/day)} = 0.3\ \mu g\ \text{methylmercury/g fish tissue}$$

Note: 0.3 µg/g fish tissue is equivalent to 0.3 mg/kg.

The initial USEPA methylmercury criteria report did not describe how the criterion should be applied to fish species with different concentrations of methylmercury. The USEPA recommends, however, that the criterion be applied using information about local consumption. Most of the fish caught and kept from Cache or Bear Creeks will be trophic level 4 fish, such as catfish, bullhead, pikeminnow, and bass. Some trophic level 3 species, such as bluegill, may also be caught and kept for consumption (CDFG, 2004b; observations by Regional Water Board staff). Humans are unlikely to consume trophic level 2 fish from Cache or Bear Creeks. A logical way to interpret the USEPA criterion for Cache and Bear Creeks, then, is to assign the criterion of 0.3 mg/kg as the average concentration of methylmercury in locally caught trophic level 4 fish. This interpretation still assumes a consumption rate of 17.5 g/day, but accounts for the local situation that most fish consumed are trophic level 4 species.

Although the USEPA fish tissue criterion is applied to trophic level 4 fish in Cache and Bear Creeks, a corresponding safe level in trophic level 3 fish can be calculated using the existing ratio of methylmercury concentrations in large, trophic level 4 and trophic level 3 fish. The existing ratio between methylmercury concentrations in similarly sized trophic level 4 and trophic level 3 fish is 2.0 (See Cache Creek TDML report for current fish data).

Equation 2

$$\frac{\text{Trophic level 4 objective}}{\text{Trophic Level 4/3 ratio}} = \text{trophic level 3 objective}$$

Applying the site-specific trophic level ratio in this equation produces a safe methylmercury level in trophic level 3 fish of 0.15 mg/kg.

$$\frac{0.3 \text{ mg/kg}}{2.0} = 0.15 \text{ mg/kg}$$

The Equation 2 calculations produce water quality objectives proposed under Alternative 3 that are the following:

0.3 mg methylmercury/kg fish muscle tissue, wet weight in Trophic Level 4 fish,
0.15 mg methylmercury/kg fish muscle tissue, wet weight in Trophic Level 3 fish.

These proposed concentrations are the average methylmercury concentrations in fillet of TL3 fish in the range 150-350 mm total length and TL4 fish in the range of 150-500 mm total length.

APPENDIX F. RECOMMENDED FORMAT FOR COMMENT LETTERS

Comment letters to the Regional Board on staff recommendations serve two purposes: 1) to point out areas of agreement; and 2) to suggest revisions to staff recommendations. Clear statements of both areas of agreement and suggested revisions will assist the Regional Board and staff in understanding the recommendations of the commenter. In order to aid staff in identifying suggested revisions and to respond to the specific issues raised by the commenter, the following format for comment letters is suggested:

Format for Comments Suggesting Revisions

The suggested format is to number the comment, state in one sentence the topic upon which the comment is directed, provide a supporting argument, and make a specific recommendation. Supporting arguments should include citations, where appropriate.

The recommended format is below.

Comment #. *One sentence description or title for the comment*

Suggested revision to the Basin Plan Amendment language or staff report. For suggested revisions to the Basin Plan Amendment language please use underline/strikeout to show changes from the staff proposal. For suggested changes to the staff report, please clearly indicate the section(s) being addressed. The discussion related to the suggested revisions should be clearly supported by reference to applicable law or scientific or technical reports, where appropriate.

Format for Comments Supporting Staff Recommendations

If the commenter concurs with a staff recommendation, a statement to that effect will assist the Regional Board in determining what action, if any, to take on the staff recommendation. In general, no supporting discussion need be presented, unless the commenter feels that the staff recommendation could be further enhanced or clarified. The recommended format is below.

Comment #. *One sentence description or title for the comment*.

The provision(s) of the proposed Basin Plan Amendment that the commenter supports should be clearly stated. The commenter may want to provide their reason for supporting the provision of the proposed Basin Plan Amendment, especially if it differs from the staff rationale. Additional legal or scientific citations can also be provided.

Appendix G. Methylmercury Data

References

Foe & Croyle	Foe, C. and W. Croyle. 1998. *Mercury Concentrations and Loads from the Sacramento River and from Cache Creek to the Sacramento-San Joaquin Delta Estuary.* California Regional Water Quality Control Board, Central Valley Region. Sacramento, CA. Staff report. June 1998.
CVRWQCB	Sampling conducted by Sacramento River Mercury TMDL Staff in 2002
CALFED1C	Domalgalski, J. and C. Alpers. 2001. *Mercury Loads to the Sacramento-San Joaquin Delta from the Cache Creek Watershed and the Yolo Bypass.* Draft Calfed Report. Subtask 1C.
CALFED5A	Suchanek, T.H., D.G. Slotton, D.C. Nelson, S.M. Ayers, C. MacDonald, R. Weyand, A. Liston, B. Cohn, K. McElroy, P. King. 2001. *Source bioavailability and Mine Remediation Feasibility in the Cache Creek Watershed.* Draft Calfed Report. Subtask 5A.
USACE	Taken from USACE Lower Cache Creek, Yolo County, CA City of Woodland and Vicinity Flood Reduction Study March 30, 2001 http://infotrek.er.usgs.gov/pls/nawqa.home
CALFED5B	Slotton, D.G., S.M. Ayers, T.H. Suchanek, R.D. Weyand, and A.M. Liston. 2002. *Mercury Bioaccumulation and Trophic Transfer in the Cache Creek Watershed, California, in Relation to Diverse Aqueous Mercury Exposure Conditions.* Draft Calfed Report. Subtask 5B.
Yolo Co	Slotton, D.G., S.M. Ayers, and J.E. Reuter. 1996. Off-Channel Gravel Pit Lakes - Mercury Considerations. Lower Cache Creek, Yolo County, California. Preliminary Study, April 1996. Prepared for Yolo County. May 2, 1996.
CCNP2	Slotton, D.G., S.M. Ayers. 2001. Cache Creek Nature Preserve Mercury Monitoring Program, Yolo County, Ca. Second Semi-Annual Data Report (Spring-Summer 2001). Prepared for Yolo County. November 20, 2001.
CCNP4	Slotton, D.G., S.M. Ayers. 2001. Cache Creek Nature Preserve Mercury Monitoring Program, Yolo County, Ca. Fourth Semi-Annual Data Report (Spring-Summer 2001). Prepared for Yolo County. December 15, 2002.

ProjID	Normalized Site Name	Date	TMeHg (ng/L)
CALFED5B	Bear Ck (mid)	01/31/00	0.58
CALFED5B	Bear Ck (mid)	03/02/00	0.26
CALFED5B	Bear Ck (mid)	04/17/00	0.35
CALFED5B	Bear Ck (mid)	06/14/00	0.17
CALFED5B	Bear Ck (mid)	08/10/00	1.09
CALFED5B	Bear Ck (mid)	10/11/00	0.13
CALFED5B	Bear Ck (mid)	11/07/00	0.32
CALFED5B	Bear Ck (mid)	12/11/00	0.22
CALFED5B	Bear Ck (mid)	01/11/01	0.47
CALFED5B	Bear Ck (mid)	02/13/01	0.71
CALFED5B	Bear Ck (mid)	03/22/01	0.33
CALFED5B	Bear Ck (mid)	05/03/01	0.19
CALFED5B	Bear Ck (mid)	06/07/01	2.79
CALFED5B	Bear Ck (mid)	07/12/01	1.14
CALFED5B	Bear Ck (mid)	08/23/01	0.58
CVRWQCB	Bear Ck @ Bear Valley Rd	02/03/04	0.0811
CVRWQCB	Bear Ck @ Bear Valley Rd	02/17/04	0.185
CVRWQCB	Bear Ck @ Bear Valley Rd	03/24/04	0.0661
CVRWQCB	Bear Ck @ Bear Valley Rd	04/28/04	0.158
CVRWQCB	Bear Ck @ Bear Valley Rd	06/09/04	0.113
CVRWQCB	Bear Ck @ Bear Valley Rd	08/03/04	0.178
CVRWQCB	Bear Ck @ Bear Valley Rd	09/22/04	0.0657
CVRWQCB	Bear Ck @ Bear Valley Rd	10/26/04	0.0976
CVRWQCB	Bear Ck @ Bear Valley Rd	02/02/05	0.053
CVRWQCB	Bear Ck @ Brim Rd	02/03/04	0.0323
CVRWQCB	Bear Ck @ Brim Rd	02/17/04	0.131
CVRWQCB	Bear Ck @ Brim Rd	03/24/04	0.0481
CVRWQCB	Bear Ck @ Brim Rd	04/28/04	0.0878
CVRWQCB	Bear Ck @ Brim Rd	06/09/04	0.202
CVRWQCB	Bear Ck @ Brim Rd	08/03/04	0.213
CVRWQCB	Bear Ck @ Brim Rd	09/22/04	0.11
CVRWQCB	Bear Ck @ Brim Rd	10/26/04	0.0378
CVRWQCB	Bear Ck @ Brim Rd	12/01/04	0.0638
CVRWQCB	Bear Ck @ Holsten Canyon	02/03/04	0.23
CVRWQCB	Bear Ck @ Holsten Canyon	02/17/04	0.293
CVRWQCB	Bear Ck @ Holsten Canyon	03/24/04	0.228
CVRWQCB	Bear Ck @ Holsten Canyon	04/28/04	0.296
CVRWQCB	Bear Ck @ Holsten Canyon	06/09/04	0.755
CVRWQCB	Bear Ck @ Holsten Canyon	08/03/04	0.604
CVRWQCB	Bear Ck @ Holsten Canyon	09/22/04	0.016
CVRWQCB	Bear Ck @ Holsten Canyon	10/26/04	0.12
CALFED5B	Bear Ck @ Hwy 20	08/23/01	0.81
CVRWQCB	Bear Ck @ Hwy 20	02/03/04	0.197
CVRWQCB	Bear Ck @ Hwy 20	02/17/04	0.457
CVRWQCB	Bear Ck @ Hwy 20	03/24/04	0.212
CVRWQCB	Bear Ck @ Hwy 20	04/28/04	0.405
CVRWQCB	Bear Ck @ Hwy 20	06/09/04	0.882
CVRWQCB	Bear Ck @ Hwy 20	08/03/04	0.109
CVRWQCB	Bear Ck @ Hwy 20	09/22/04	0.115
CVRWQCB	Bear Ck @ Hwy 20	10/26/04	0.257
CVRWQCB	Bear Ck @ Hwy 20	12/01/04	0.143
CVRWQCB	Bear Ck @ Hwy 20	02/02/05	0.192
Foe & Croyle	Bear Ck u/s Cache Ck Confluence	07/12/01	0.82

CVRWQCB	Bear Ck u/s Cache Ck Confluence	12/29/03	0.342
CVRWQCB	Bear Ck u/s Cache Ck Confluence	02/03/04	0.273
CVRWQCB	Bear Ck u/s Cache Ck Confluence	03/24/04	0.176
CVRWQCB	Bear Ck u/s Cache Ck Confluence	04/28/04	0.0234
CVRWQCB	Bear Ck u/s Cache Ck Confluence	04/28/04	0.499
CVRWQCB	Bear Ck u/s Cache Ck Confluence	06/09/04	0.763
CVRWQCB	Bear Ck u/s Cache Ck Confluence	06/09/04	0.814
CVRWQCB	Bear Ck u/s Cache Ck Confluence	12/01/04	0.0695
CVRWQCB	Bear Ck u/s Cache Ck Confluence	12/01/04	0.0622
CVRWQCB	Bear Ck u/s Cache Ck Confluence	02/02/05	0.151
CVRWQCB	Bear Ck u/s Cache Ck Confluence	02/02/05	0.141
CALFED5B	Cache @ 505	03/16/00	0.151
CALFED5B	Cache @ 505	04/17/00	1.08
CALFED1C	Cache @ 505	06/13/00	0.27
CALFED5B	Cache @ 505	06/14/00	0.267
CALFED5B	Cache @ 505	08/10/00	0.1424
CALFED5B	Cache @ 505	10/11/00	0.188
CALFED5B	Cache @ 505	10/11/00	0.188
CALFED5B	Cache @ 505	11/07/00	0.072
CALFED5B	Cache @ 505	12/11/00	0.0878
CALFED5B	Cache @ 505	01/11/01	0.0885
CALFED5B	Cache @ 505	02/13/01	0.228
Yolo Co	Cache Ck - Solano Gravel	04/04/96	0.329
Yolo Co	Cache Ck - Solano Gravel	04/09/96	0.116
Yolo Co	Cache Ck - Solano Gravel	04/11/96	0.114
Yolo Co	Cache Ck - Solano Gravel	04/15/96	0.114
CVRWQCB	Cache Ck @ Anderson Marsh Entrance	08/25/04	0.123
CVRWQCB	Cache Ck @ Anderson Marsh Entrance	02/02/05	0.054
CALFED5B	Cache Ck @ Rumsey	01/31/00	0.783
CALFED1C	Cache Ck @ Rumsey	01/31/00	0.78
CALFED1C	Cache Ck @ Rumsey	02/28/00	0.127
CALFED5B	Cache Ck @ Rumsey	03/02/00	0.22
CALFED5B	Cache Ck @ Rumsey	03/16/00	0.104
CALFED1C	Cache Ck @ Rumsey	03/16/00	0.0694
CALFED5B	Cache Ck @ Rumsey	04/17/00	0.407
CALFED1C	Cache Ck @ Rumsey	06/13/00	0.2
CALFED5B	Cache Ck @ Rumsey	06/14/00	0.196
CALFED5B	Cache Ck @ Rumsey	08/10/00	0.231
CALFED5B	Cache Ck @ Rumsey	10/11/00	0.111
CALFED5B	Cache Ck @ Rumsey	11/07/00	0.0548
CALFED5B	Cache Ck @ Rumsey	12/11/00	0.03685
CALFED5B	Cache Ck @ Rumsey	01/11/01	0.0376
CALFED5B	Cache Ck @ Rumsey	02/13/01	0.284
CALFED5B	Cache Ck @ Rumsey	03/22/01	0.104
CALFED5B	Cache Ck @ Rumsey	05/03/01	0.295
CALFED5B	Cache Ck @ Rumsey	06/07/01	0.17
CVRWQCB	Cache Ck @ Rumsey	12/29/03	0.32
CVRWQCB	Cache Ck @ Rumsey	12/29/03	0.268
CVRWQCB	Cache Ck @ Rumsey	02/17/04	0.581
CVRWQCB	Cache Ck @ Rumsey	03/24/04	0.119
CVRWQCB	Cache Ck @ Rumsey	04/28/04	0.169
CVRWQCB	Cache Ck @ Rumsey	06/09/04	0.264
CVRWQCB	Cache Ck @ Rumsey	06/09/04	0.299
CVRWQCB	Cache Ck @ Rumsey	08/03/04	0.315
CVRWQCB	Cache Ck @ Rumsey	09/22/04	0.347

CVRWQCB	Cache Ck @ Rumsey	10/25/04	0.151
CVRWQCB	Cache Ck @ Rumsey	12/01/04	0.0488
CVRWQCB	Cache Ck @ Rumsey	02/03/05	0.0754
CCNP2	Cache Ck d/s Gordon Slough	09/26/01	0.22
CCNP4	Cache Ck d/s Gordon Slough	04/18/02	0.112
CCNP2	Cache Ck d/s Preserve	09/26/01	0.21
CCNP4	Cache Ck d/s Preserve	04/18/02	0.097
CVRWQCB	Cache Ck North Fork @ Hwy 20	08/03/04	0.136
CVRWQCB	Cache Ck North Fork @ Hwy 20	09/22/04	0.109
CVRWQCB	Cache Ck North Fork @ Hwy 20	10/26/04	0.0865
CVRWQCB	Cache Ck North Fork @ Hwy 20	12/01/04	0.087
CVRWQCB	Cache Ck North Fork @ South Fork Confluence	10/26/04	0.101
CVRWQCB	Cache Ck North Fork d/s IVR Dam	06/09/04	0.112
CVRWQCB	Cache Ck North Fork d/s IVR Dam	09/22/04	0.133
CVRWQCB	Cache Ck North Fork d/s IVR Dam	10/26/04	0.17
CVRWQCB	Cache Ck North Fork u/s South Fork Confluence	03/24/04	0.0875
CVRWQCB	Cache Ck North Fork u/s South Fork Confluence	04/28/04	0.093
CVRWQCB	Cache Ck North Fork u/s South Fork Confluence	09/22/04	0.0991
CVRWQCB	Cache Ck North Fork u/s South Fork Confluence	12/01/04	0.0532
CVRWQCB	Cache Ck North Fork u/s South Fork Confluence	02/02/05	0.0681
CVRWQCB	Cache Ck South Fork u/s North Fork Confluence	03/24/04	0.172
CVRWQCB	Cache Ck South Fork u/s North Fork Confluence	04/28/04	0.233
CVRWQCB	Cache Ck South Fork u/s North Fork Confluence	06/09/04	0.307
CVRWQCB	Cache Ck South Fork u/s North Fork Confluence	08/03/04	0.409
CVRWQCB	Cache Ck South Fork u/s North Fork Confluence	09/22/04	0.205
CVRWQCB	Cache Ck South Fork u/s North Fork Confluence	10/26/04	0.182
CVRWQCB	Cache Ck South Fork u/s North Fork Confluence	02/02/05	0.176
CVRWQCB	Cache Ck u/s Bear Ck Confluence	03/24/04	0.109
CVRWQCB	Cache Ck u/s Bear Ck Confluence	04/28/04	0.203
CVRWQCB	Cache Ck u/s Bear Ck Confluence	06/09/04	0.224
CVRWQCB	Cache Ck u/s Bear Ck Confluence	08/03/04	0.296
CVRWQCB	Cache Ck u/s Bear Ck Confluence	08/03/04	0.293
CVRWQCB	Cache Ck u/s Bear Ck Confluence	09/22/04	0.283
CVRWQCB	Cache Ck u/s Bear Ck Confluence	10/26/04	0.183
CVRWQCB	Cache Ck u/s Bear Ck Confluence	12/01/04	0.0709
CVRWQCB	Cache Ck u/s Bear Ck Confluence	02/02/05	0.0879
CCNP2	Cache Ck u/s Preserve	09/26/01	0.12
CCNP4	Cache Ck u/s Preserve	04/18/02	0.096
CVRWQCB	Cache Creek North Fork d/s IVR Dam	04/28/04	0.058
CCNP2	Cache Preserve Outflow	05/08/01	0.38
CCNP2	Cache Preserve Outflow	07/26/01	0.49
CCNP2	Cache Preserve Outflow	09/26/01	0.38
CCNP4	Cache Preserve Outflow	04/18/02	0.236
CALFED1C	CCSB Inflow	01/31/00	0.18
CALFED1C	CCSB Inflow	03/01/00	0.576
CALFED1C	CCSB Inflow	03/18/00	0.0877
CALFED1C	CCSB Inflow	06/13/00	0.26
CVRWQCB	CCSB Inflow	02/17/04	0.633
CVRWQCB	CCSB Inflow	03/24/04	0.153
CVRWQCB	CCSB Inflow	04/28/04	0.237
CVRWQCB	CCSB Inflow	06/09/04	0.263
CVRWQCB	CCSB Inflow	08/03/04	0.417
CVRWQCB	CCSB Inflow	09/22/04	0.311
CVRWQCB	CCSB Inflow	10/25/04	0.134
CVRWQCB	CCSB Inflow	12/01/04	0.083

CVRWQCB	CCSB Inflow	02/03/05	0.0816
CALFED1C	CCSB Outflow	03/01/00	0.443
CALFED1C	CCSB Outflow	03/18/00	0.204
CVRWQCB	CCSB Outflow	12/29/03	0.153
CVRWQCB	CCSB Outflow	02/17/04	0.621
CVRWQCB	CCSB Outflow	02/17/04	0.587
CVRWQCB	CCSB Outflow	03/24/04	0.378
CVRWQCB	CCSB Outflow	03/24/04	0.339
CVRWQCB	CCSB Outflow	04/28/04	0.317
CVRWQCB	CCSB Outflow	06/09/04	0.803
CVRWQCB	CCSB Outflow	08/03/04	0.498
CVRWQCB	CCSB Outflow	09/22/04	0.235
CVRWQCB	CCSB Outflow	10/25/04	0.181
CVRWQCB	CCSB Outflow	12/01/04	0.271
CVRWQCB	CCSB Outflow	02/03/05	0.366
CALFED1C	Clear Lake Outflow	01/31/00	0.11
CALFED5B	Clear Lake Outflow	01/31/00	0.111
CALFED1C	Clear Lake Outflow	02/29/00	0.128
CALFED5B	Clear Lake Outflow	03/02/00	0.145
CALFED1C	Clear Lake Outflow	03/17/00	0.0478
CALFED5B	Clear Lake Outflow	04/17/00	0.466
CALFED1C	Clear Lake Outflow	06/13/00	0.12
CALFED5B	Clear Lake Outflow	06/13/00	0.124
CALFED5B	Clear Lake Outflow	08/10/00	0.182
CALFED5B	Clear Lake Outflow	10/11/00	0.0267
CALFED5B	Clear Lake Outflow	11/07/00	0.02
CALFED5B	Clear Lake Outflow	12/11/00	0.0217
CALFED5B	Clear Lake Outflow	01/11/01	0.0513
CALFED5B	Clear Lake Outflow	02/13/01	0.0869
CALFED5B	Clear Lake Outflow	03/22/01	0.138
CALFED5B	Clear Lake Outflow	05/03/01	0.257
CALFED5B	Clear Lake Outflow	06/07/01	0.134
CVRWQCB	Clear Lake Outflow	02/17/04	0.297
CVRWQCB	Clear Lake Outflow	03/24/04	0.204
CVRWQCB	Clear Lake Outflow	04/28/04	0.24
CVRWQCB	Clear Lake Outflow	06/09/04	0.231
CVRWQCB	Clear Lake Outflow	08/03/04	0.336
CVRWQCB	Clear Lake Outflow	08/25/04	0.159
CVRWQCB	Clear Lake Outflow	08/25/04	0.122
CVRWQCB	Clear Lake Outflow	09/22/04	0.104
CVRWQCB	Clear Lake Outflow	10/25/04	0.225
CVRWQCB	Clear Lake Outflow	12/01/04	0.0379
CVRWQCB	South Fork Cache Ck d/s Clear Lake Dam	02/02/05	0.134
CALFED5B	Davis Ck d/s Reservoir	03/10/00	0.273
CALFED5B	Davis Ck d/s Reservoir	06/13/00	0.737
CALFED5B	Davis Ck d/s Reservoir	11/06/00	0.0218
CALFED5B	Davis Ck u/s Reservoir	06/13/00	0.361
CALFED5B	Davis Ck u/s Reservoir	08/10/00	0.242
CALFED5B	Davis Ck u/s Reservoir	11/06/00	0.108
CVRWQCB	Rathburn Mine Cks #3,4,5	12/01/04	2.42
CCNP2	Gordon Slough Inflow	05/08/01	0.35
CCNP2	Gordon Slough Inflow	07/26/01	0.2
CCNP2	Gordon Slough Inflow	09/26/01	0.17
CCNP4	Gordon Slough Inflow	04/18/02	0.182
CVRWQCB	Grizzly Ck	02/17/04	1.07

CVRWQCB	Harley Gulch East u/s Confluence	02/02/05	0.0251
CALFED1C	Harley Gulch @ Gage	01/31/00	0.98
CALFED5B	Harley Gulch @ Gage	01/31/00	0.983
CALFED5B	Harley Gulch @ Gage	02/14/00	0.354
CALFED5A	Harley Gulch @ Gage	02/14/00	0.354
CALFED1C	Harley Gulch @ Gage	02/27/00	0.0667
CALFED5B	Harley Gulch @ Gage	03/02/00	0.121
CALFED1C	Harley Gulch @ Gage	03/15/00	0.0894
CALFED5B	Harley Gulch @ Gage	04/17/00	0.453
CALFED1C	Harley Gulch @ Gage	06/13/00	7.76
CALFED5B	Harley Gulch @ Gage	06/13/00	7.76
CALFED5B	Harley Gulch @ Gage	01/11/01	1.088
CALFED5B	Harley Gulch @ Gage	02/13/01	0.662
CALFED5B	Harley Gulch @ Gage	05/03/01	8.555
CVRWQCB	Harley Gulch @ Gage	12/29/03	0.297
CVRWQCB	Harley Gulch @ Gage	02/16/04	1.24
CVRWQCB	Harley Gulch @ Gage	02/16/04	1.19
CVRWQCB	Harley Gulch @ Gage	02/17/04	0.444
CVRWQCB	Harley Gulch @ Gage	02/17/04	0.478
CVRWQCB	Harley Gulch @ Gage	03/24/04	0.199
CVRWQCB	Harley Gulch @ Gage	04/28/04	12.5
CVRWQCB	Harley Gulch @ Gage	04/28/04	6.91
CVRWQCB	Harley Gulch @ Gage	06/09/04	18
CVRWQCB	Harley Gulch @ Gage	08/03/04	0.641
CVRWQCB	Harley Gulch @ Gage	09/22/04	1.81
CVRWQCB	Harley Gulch @ Gage	10/25/04	3.66
CVRWQCB	Harley Gulch @ Gage	12/01/04	1.32
CVRWQCB	Harley Gulch @ Gage	12/01/04	1.01
CVRWQCB	Harley Gulch @ Gage	02/02/05	0.0639
CVRWQCB	Harley Gulch d/s Abbott Mine	04/28/04	0.189
CVRWQCB	Harley Gulch d/s Abbott Mine	06/09/04	1.43
CVRWQCB	Harley Gulch East	12/29/03	0.326
CVRWQCB	Harley Gulch East	02/16/04	0.791
CVRWQCB	Harley Gulch East	02/17/04	0.256
CVRWQCB	Harley Gulch East	03/24/04	0.0461
CVRWQCB	Harley Gulch East	04/28/04	0.0442
CVRWQCB	Harley Gulch East	06/09/04	2.08
CVRWQCB	Harley Gulch East	08/03/04	82.1
CVRWQCB	Harley Gulch East	09/22/04	1.33
CVRWQCB	Harley Gulch East	10/25/04	0.615
CVRWQCB	Harley Gulch East	12/01/04	0.444
CVRWQCB	Harley Gulch West	12/29/03	1.62
CVRWQCB	Harley Gulch West	12/29/03	1.68
CVRWQCB	Harley Gulch West	02/16/04	4.2
CVRWQCB	Harley Gulch West	02/17/04	1.18
CVRWQCB	Harley Gulch West	03/24/04	0.371
CVRWQCB	Harley Gulch West	04/28/04	5.41
CVRWQCB	Harley Gulch West	06/09/04	23.1
CVRWQCB	Harley Gulch West	08/03/04	DRY
CVRWQCB	Harley Gulch West d/s Wetland	09/22/04	0.26
CVRWQCB	Harley Gulch West d/s Wetland	10/25/04	0.26
CVRWQCB	Harley Gulch West d/s Wetland	12/01/04	0.0366
CVRWQCB	Harley Gulch West u/s Wetland	02/16/04	5.96
CVRWQCB	Harley Gulch West u/s Wetland	02/17/04	1.08
CVRWQCB	Harley Gulch West u/s Wetland	03/24/04	0.179

CVRWQCB	Harley Gulch West u/s Wetland	04/28/04	0.168
CVRWQCB	Harley Gulch West u/s Wetland	06/09/04	1.56
CVRWQCB	Harley Gulch West u/s Wetland	08/03/04	24
CVRWQCB	Harley Gulch West u/s Wetland	09/22/04	0.138
CVRWQCB	Harley Gulch West u/s Wetland	10/25/04	0.167
CVRWQCB	Harley Gulch West u/s Wetland	12/01/04	0.157
CVRWQCB	Harley Gulch West u/s Wetland	02/02/05	0.298
CVRWQCB	Harley Gulch West u/s Confluence	02/02/05	0.0795
CVRWQCB	Hog Hollow Ck	02/17/04	0.102
CVRWQCB	Long Valley	02/17/04	0.173
CALFED1C	North Fork (Upper)	02/29/00	0.0289
CALFED1C	North Fork (Upper)	03/17/00	<0.0230
Foe & Croyle	North Fork @ Hwy 20	01/31/00	0.169
CALFED1C	North Fork @ Hwy 20	01/31/00	0.17
CALFED1C	North Fork @ Hwy 20	02/27/00	0.0821
CALFED5B	North Fork @ Hwy 20	03/02/00	0.0672
CALFED5B	North Fork @ Hwy 20	03/16/00	0.05025
CALFED1C	North Fork @ Hwy 20	03/16/00	<0.0244
CALFED5B	North Fork @ Hwy 20	04/17/00	0.0229
CALFED5B	North Fork @ Hwy 20	06/13/00	0.0803
CALFED1C	North Fork @ Hwy 20	06/13/00	0.08
CALFED5B	North Fork @ Hwy 20	08/10/00	0.19
CALFED5B	North Fork @ Hwy 20	10/11/00	0.0374
CALFED5B	North Fork @ Hwy 20	11/07/00	0.02
CALFED5B	North Fork @ Hwy 20	12/11/00	0.0273
CALFED5B	North Fork @ Hwy 20	01/11/01	0.0636
CALFED5B	North Fork @ Hwy 20	03/22/01	0.0927
CALFED5B	North Fork @ Hwy 20	05/03/01	0.0723
CVRWQCB	North Fork @ Hwy 20	12/29/03	0.347
CVRWQCB	North Fork @ Hwy 20	02/17/04	0.442
CVRWQCB	North Fork @ Hwy 20	03/24/04	0.0491
CVRWQCB	North Fork @ Hwy 20	04/28/04	0.07
CVRWQCB	North Fork @ Hwy 20	06/09/04	0.0927
CVRWQCB	Cache Ck North Fork @ Hwy 20	02/02/05	0.0461
CVRWQCB	North Fork Cache Ck d/s IVR Dam	08/03/04	0.172
CVRWQCB	North Fork Cache Ck u/s South Fork Confluence	06/09/04	0.0929
CVRWQCB	North Fork Cache u/s Wolf Ck	02/17/04	0.163
CVRWQCB	North Fork Cache u/s Wolf Ck	03/24/04	0.0995
CVRWQCB	North Fork Cache u/s Wolf Ck	04/28/04	0.069
CVRWQCB	North Fork Cache u/s Wolf Ck	06/09/04	0.089
CVRWQCB	North Fork Confluence	08/03/04	0.101
CVRWQCB	North Fork d/s IVR Dam	03/24/04	0.0612
CVRWQCB	Cache Ck North Fork d/s IVR Dam	02/02/05	0.106
CVRWQCB	Ponded area by mine cks	08/03/04	1.41
CVRWQCB	Siegler Ck	12/01/04	0.0588
CVRWQCB	South Fork Cache Ck d/s Clear Lake Dam	02/02/05	0.135
CVRWQCB	Sulphur Ck	12/01/04	1.22
CALFED5B	Sulphur Ck @ Gage	01/31/00	2.46
CalFED1C	Sulphur Ck @ Gage	01/31/00	2.46
CALFED5B	Sulphur Ck @ Gage	02/14/00	0.481
CALFED5A	Sulphur Ck @ Gage	02/14/00	0.481
CalFED1C	Sulphur Ck @ Gage	02/27/00	0.334
CALFED5B	Sulphur Ck @ Gage	03/02/00	0.2195
CalFED1C	Sulphur Ck @ Gage	03/15/00	0.0611
CALFED5B	Sulphur Ck @ Gage	04/17/00	0.659

CalFED1C	Sulphur Ck @ Gage	06/13/00	0.76
CALFED5B	Sulphur Ck @ Gage	06/14/00	0.7645
CALFED5B	Sulphur Ck @ Gage	08/10/00	4.04
CALFED5B	Sulphur Ck @ Gage	10/11/00	1.57
CALFED5B	Sulphur Ck @ Gage	11/07/00	1.3
CALFED5B	Sulphur Ck @ Gage	01/11/01	0.92
CALFED5B	Sulphur Ck @ Gage	02/13/01	0.405
CALFED5A	Sulphur Ck @ Gage	02/22/01	0.489
CALFED5B	Sulphur Ck @ Gage	05/03/01	0.149
CALFED5B	Sulphur Ck @ Gage	07/12/01	18.2
CALFED5B	Sulphur Ck @ Gage	08/23/01	20.6
CVRWQCB	Sulphur Ck @ Gage	12/14/03	0.17
CVRWQCB	Sulphur Ck @ Gage	12/29/03	0.951
CVRWQCB	Sulphur Ck @ Gage	02/03/04	0.277
CVRWQCB	Sulphur Ck @ Gage	02/16/04	3.05
CVRWQCB	Sulphur Ck @ Gage	02/16/04	2.54
CVRWQCB	Sulphur Ck @ Gage	02/17/04	1.1
CVRWQCB	Sulphur Ck @ Gage	02/25/04	1.93
CVRWQCB	Sulphur Ck @ Gage	02/25/04	1.74
CVRWQCB	Sulphur Ck @ Gage	03/24/04	0.175
CVRWQCB	Sulphur Ck @ Gage	04/28/04	0.441
CVRWQCB	Sulphur Ck @ Gage	08/03/04	3.36
CALFED5B	Upper Bear Ck	03/02/00	0.103
CALFED5B	Upper Bear Ck	06/14/00	0.212
CALFED5B	Upper Bear Ck	10/11/00	0.0868
CALFED5B	Upper Bear Ck	11/07/00	0.0534
CALFED5B	Upper Bear Ck	12/11/00	0.0669
CALFED5B	Upper Bear Ck	01/11/01	0.177
CALFED5B	Upper Bear Ck	02/13/01	0.0501
CALFED5B	Upper Bear Ck	03/22/01	0.0676
CALFED5B	Upper Bear Ck	05/03/01	0.0636
CALFED5B	Upper Bear Ck	06/07/01	0.228
CALFED5B	Upper Bear Ck	07/12/01	0.295
CALFED5B	Upper Bear Ck	08/23/01	0.09
CVRWQCB	Wolf Ck	02/17/04	0.0926
CALFED5B	Yolo	01/31/00	0.181
CALFED5B	Yolo	03/02/00	0.348
CALFED5B	Yolo	04/17/00	0.51
CALFED5B	Yolo	06/14/00	0.256
CALFED5B	Yolo	08/10/00	0.476
CALFED5B	Yolo	10/11/00	0.178
CALFED5B	Yolo	11/07/00	0.0914
CVRWQCB	Harley Gulch West u/s Wetland	03/02/05	0.255
CVRWQCB	Harley Gulch East	03/02/05	0.0649
CVRWQCB	Harley Gulch West	03/02/05	0.142
CVRWQCB	Harley Gulch @ Gage	03/02/05	0.115
CVRWQCB	CCSB Inflow	03/02/05	0.175
CVRWQCB	Cache Ck @ Rumsey	03/29/05	0.0488
CVRWQCB	Clear Lake Outflow	03/02/05	0.0736
CVRWQCB	Cache Ck North Fork d/s Indian Valley Reservoir	03/01/05	0.139
CVRWQCB	Cache Ck North Fork @ Hwy 20	03/01/05	0.11
CVRWQCB	Cache Ck South Fork u/s North Fork Confluence	03/01/05	0.131
CVRWQCB	Cache Ck North Fork u/s South Fork Confluence	03/01/05	0.0675
CVRWQCB	Bear Ck @ Brim Rd	03/01/05	0.0919
CVRWQCB	Bear Ck @ Bear Valley Rd	03/01/05	0.0682

CVRWQCB	Sulphur Ck u/s Bear Ck Confluence	03/01/05	0.139
CVRWQCB	Bear Ck u/s Sulphur Ck Confluence	03/01/05	0.123
CVRWQCB	Bear Ck @ Hwy 20	03/01/05	0.275
CVRWQCB	Bear Ck u/s Cache Ck Confluence	03/01/05	0.208
CVRWQCB	Cache Ck u/s Bear Ck Confluence	03/01/05	0.109
CVRWQCB	Rumsey	03/01/05	0.177
CVRWQCB	CCSB Outflow	03/01/05	0.299
CVRWQCB	CCSB Outflow	03/16/05	0.159
CVRWQCB	CCSB Outflow	03/16/05	0.138

Appendix H. Revised Methylmercury Load Allocations for Cache and Bear Creeks

The proposed amendment for Chapter 4 of the Basin Plan contains load allocations for methylmercury in Cache and Bear Creeks and their tributaries and stream sections. These load allocations incorporate revisions of the allocations originally published in the Cache Creek, Bear Creek and Harley Gulch TMDL for Mercury report. Section 6 of the TMDL report contained an explanation and tables for calculation of the methylmercury load allocations. The revised allocations were calculated using the same methodology as described in the TMDL report with the following changes:

1. In the revised calculations, the aqueous methylmercury goals are defined as annual average concentrations and are compared with existing average concentrations. In the original calculations, both were median values. Using the average for the goals and existing conditions is more appropriate than using the median, because the linkage analysis relationships were developed using average concentrations of methylmercury in water and fish tissue. The aqueous methylmercury goals are derived directly from the linkage relationships (Figures 5.1 and 5.2 of this report).
2. The set of methylmercury concentration data includes data collected up to February 2005. This data is provided in another appendix.

The following tables replace Tables 6.1, 6.2, 6.3, and 6.4 of the Cache Creek TMDL report. Please refer to the TMDL report for an explanation of the 2-step process for calculating load allocations.

TMDL Table 6.1 (revised) Reductions in Aqueous Methylmercury Concentrations to Meet Numeric Objectives in Cache Creek

Tributary	Existing average MeHg, ng/L	Aqueous MeHg goal, as average, ng/L	Reduction needed to meet goal, as % of existing concentration
SF	0.17	0.14	18
NF	0.1	0.14	-40
Harley	2.5	0.09	96
Bear	0.44	0.06	86
Cache @ Yolo	0.26	0.14	46
Cache@ SB outflow	0.35	0.14	60

Table 6.2 revise. Allocation of Methylmercury Loads to Cache Creek

	Existing loads, g/yr	Allocation (as percent)	Future load g/yr
Cache u/s NF confluence	36.8	30	11.0
NF	12.4	100	12.4
Harley	1	4	0.0
Davis C	1.3	50	0.7
Bear	21.1	14	3.0
net in channel	49.5	65	32.0
MOS (10% of future loads)			7
Cache @ Yolo	122.1	54	66
Settling Basin	86.8	40	34.72

TMDL Table 6.3 (revised) Reductions in Aqueous Methylmercury Concentrations to Meet Numeric Objectives in Bear Creek

	Existing average MeHg, ng/L	Aqueous MeHg goal as average, ng/L	Reduction, as % existing avg concentration
Bear Creek @BV Rd	0.12	0.06	50
Bear Creek at gauge	0.44	0.06	86

TMDL Table 6.4 (revised) Allocation of Methylmercury Loads to Bear Creek

	Existing load, g/yr	Load Allocation, as% existing loads	Acceptable Load based on 2000 loads, g/yr
Bear Creek @BV Rd	1.7	50	0.85
Sulphur Creek	8	10	0.8
net in channel	11.4	10	1.14
MOS (10% of future loads)			0.3
Bear Creek at gauge	21.1	15	3.16

APPENDIX I.
DRAFT RESOLUTION AND
PROPOSED BASIN PLAN AMENDMENTS

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

RESOLUTION NO. R5-2005-____

AMENDING THE WATER QUALITY CONTROL PLAN
FOR
THE SACRAMENTO RIVER AND SAN JOAQUIN RIVER BASINS
FOR THE CONTROL OF MERCURY IN CACHE CREEK,
BEAR CREEK, SULPHUR CREEK, AND HARLEY GULCH

WHEREAS, in 1975 the California Regional Water Quality Control Board, Central Valley Region, (hereafter Central Valley Board) adopted a Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (hereafter Basin Plan), which has been amended occasionally; and

WHEREAS, the Basin Plan may be amended in accordance with the California Water Code Section 13240, et seq.; and

WHEREAS, Water Code section 13241 requires the Central Valley Board to establish water quality objectives and Water Code section 13242 requires a program for implementation for achieving water quality objectives; and

WHEREAS, Cache Creek, Bear Creek, Sulphur Creek, and Harley Gulch (hereafter Cache Creek watershed) have been identified under the federal Clean Water Act section 303(d) as impaired waterbodies due to either elevated concentrations of mercury in water, methylmercury in fish tissue, or the existence of a fish consumption advisory; and

WHEREAS, the Central Valley Board recognizes that the Basin Plan does not include numeric water quality objectives for mercury nor a plan to reduce mercury concentrations in the Cache Creek watershed, therefore, a Basin Plan amendment to adopt water quality objectives and an implementation policy necessary to protect beneficial uses is appropriate; and

WHEREAS, the Central Valley Board has developed a water quality management strategy as a Basin Plan amendment to reduce the concentrations of methylmercury in fish tissue that is based on reducing the overall mercury and methylmercury loads to the Cache Creek watershed; and

WHEREAS, the proposed amendment modifies Basin Plan Chapter II (Existing and Potential Beneficial Uses) to include commercial and sport fishing as a beneficial use designation for Cache Creek, North Fork Cache Creek, and Bear Creek; and

WHEREAS, the proposed amendment modifies Basin Plan Chapter III (Water Quality Objectives) to establish site-specific numeric objectives for methylmercury in fish in Cache Creek, Bear Creek, and Harley Gulch; and

WHEREAS, the proposed amendment modifies Basin Plan Chapter IV (Implementation) to establish a water quality management strategy to reduce mercury and methylmercury loads into the Cache Creek watershed, including the requirements of a Total Maximum Daily Load for Cache Creek, Bear Creek, and Harley Gulch; and

WHEREAS, the proposed amendment modifies Basin Plan Chapter V (Surveillance and Monitoring) to include a water, sediment, and fish tissue monitoring program to monitor progress in achieving mercury and methylmercury concentration reductions; and

WHEREAS, the proposed amendment requires the owners of inactive mines to develop and implement plans to reduce mercury discharges from the mines, and it requires federal, state, and local agencies to develop and implement plans to reduce mercury and methylmercury loads from areas with mercury-contaminated sediments or methylmercury sources; and

WHEREAS, the Central Valley Board has considered the costs of implementing the proposed amendment, and finds these costs to be reasonable relative to the water quality benefits derived from implementing the proposed amendment; and

WHEREAS, Central Valley Board staff developed a draft staff report and draft Basin Plan Amendment for external scientific peer review in March 2004 in accordance with Health and Safety Code Section 57004 and the draft final staff report and amendment have been changed to conform to the recommendations of the peer reviewers or staff has provided an explanation of why no change was made; and

WHEREAS, the Central Valley Board finds that the scientific portions of the Basin Plan Amendment are based on sound scientific knowledge, methods, and practices in accordance with Health and Safety Code section 57004; and

WHEREAS, Central Valley Board staff developed a report for public comment and peer review and held a California Environmental Quality Act (CEQA) scoping meeting on 2 June 2004, the Central Valley Board held a workshop on 18 March 2005, and the Central Valley Board held public hearings on 23 June 2005 and ____2005 to consider the proposed amendment; and

WHEREAS, the basin planning process has been certified as "functionally equivalent" to CEQA requirements for preparing environmental documents and is, therefore, exempt from those requirements (Public Resources Code, section 21000 et seq.); and

WHEREAS, Central Valley Board staff completed an environmental checklist and functional equivalent document in compliance with the provisions of CEQA that concluded that the proposed amendment will have no potential for adverse effects, either individually or cumulatively, on wildlife or the environment; and

WHEREAS, Central Valley Board staff has circulated a Notice of Public Hearing, Notice of Filing, a written staff report, an environmental checklist, and a draft proposed amendment to interested individuals and public agencies for review and comment in accordance with state and federal environmental regulations (23 CCR section 3775, 40 CFR part 25, and 40 CFR part 131); and

WHEREAS, the proposed amendment will not result in degradation of Cache Creek water quality with respect to water quality currently achieved or provided for in the water body and maintains the level of water quality necessary to protect existing and anticipated beneficial use; and

WHEREAS, the proposed amendment is consistent with the State Water Resources Control Board Resolution No. 68-16, in that the changes to water quality objectives (i) consider maximum benefits to the people of the state, (ii) will not unreasonably affect present and anticipated beneficial use of waters, and (iii) will not result in water quality less than that prescribed in policies, and the proposed amendment is consistent with the federal Antidegradation Policy (40 CFR part 131.12); and

WHEREAS, this Basin Plan amendment must be approved by the State Water Resources Control Board, the Office of Administrative Law, and the U.S. Environmental Protection Agency before becoming effective; and

WHEREAS, this regulatory action meets the "Necessity" standard of the Administrative Procedures Act, Government Code, section 11353, subdivision (b):

THEREFORE BE IT RESOLVED, that the Central Valley Board certifies the staff report and environmental checklist as a functional equivalent document under CEQA for the Basin Plan; and be it further

RESOLVED, pursuant to Water Code sections 13240, et seq., the Central Valley Board, after considering the entire record, including oral testimony at the hearing, hereby approves the staff report and adopts an amendment to the Basin Plan to include commercial and sport fishing as a beneficial use, to establish site-specific numeric water quality objectives for methylmercury, and to establish a water quality management strategy to reduce mercury and methylmercury loads Cache Creek, Bear Creek, Sulphur Creek, and Harley Gulch as set forth in Attachment 1; and be it further

RESOLVED, that the Executive Officer is directed to forward copies of the Basin Plan amendment to the State Water Resources Control Board in accordance with the requirements of Section 13245 of the California Water Code; and be it further

RESOLVED, that the Central Valley Board requests that the State Water Resources Control Board approve the Basin Plan amendment in accordance with the requirements of Sections 13245 and 13246 of the California Water Code and forward it to the Office of Administrative Law and the U.S. Environmental Protection Agency; and be it further

RESOLVED, that, if during its approval process the State Water Resources Control Board, or Office of Administrative Law, or U.S. Environmental Protection Agency determines that minor, non-substantive corrections to the language of the amendment are needed for clarity or consistency, the Executive Officer may make such changes, and shall inform the Central Valley Board of any such changes; and be it further

RESOLVED, the Executive Officer is authorized to sign a Certificate of Fee Exemption and following approval of the Basin Plan amendment by the U.S. Environmental Protection Agency submit this Certificate in lieu of payment of the Department of Fish and Game filing fee to the Secretary for Resources; and be it further

RESOLVED, following approval of the Basin Plan amendment by the U.S. Environmental Protection Agency, the Executive Officer shall file a Notice of Decision with the State Clearinghouse.

I, THOMAS R. PINKOS, Executive Officer, do hereby certify that the forgoing is a full, true, and correct copy of a Resolution adopted by the California Regional Water Quality Control Board, Central Valley Region, on ____ October 2005.

____
THOMAS R. PINKOS, Executive Officer

ATTACHMENT 1
RESOLUTION NO. R5-2005-_______
AMENDING THE WATER QUALITY CONTROL PLAN FOR
THE SACRAMENTO RIVER AND SAN JOAQUIN RIVER BASINS
FOR THE CONTROL OF MERCURY IN CACHE CREEK,
BEAR CREEK, SULPHUR CREEK, AND HARLEY GULCH

Text additions to the existing Basin Plan language are indicated by underline and text deletions are indicated by ~~strikethrough~~. Revise Basin Plan sections as follows:

Revise Chapter II (Existing and Potential Beneficial Uses), Table II-1 to add a footnote for Cache Creek Clear Lake to Yolo Bypass:

Cache Creek Clear Lake to Yolo Bypass (d)

Footnote: "(d) In addition to the beneficial uses noted in Table II-1, COMM exists for Cache Creek from Clear Lake to Yolo Bypass and in the following tributaries only: North Fork Cache Creek and Bear Creek."

Revise Chapter III (Water Quality Objectives), Methylmercury, as follows:

For Clear Lake (53), the methylmercury concentration in fish tissue shall not exceed 0.09 and 0.19 mg methylmercury/kg wet weight of tissue in trophic level 3 and 4 fish, respectively. ~~Compliance with these objectives shall be determined by analysis of fish tissue as described in Chapter V, Surveillance and Monitoring.~~

For Cache Creek (Clear Lake to Yolo Bypass) (54), North Fork Cache Creek, and Bear Creek (tributary to Cache Creek), the average methylmercury concentration shall not exceed 0.12 and 0.23 mg methylmercury/ kg wet weight of muscle tissue in trophic level 3 and 4 fish, respectively. For Harley Gulch (tributary to Cache Creek), the average methylmercury concentration shall not exceed 0.05 mg methylmercury/ kg wet weight in whole, trophic level 2 and 3 fish.

Compliance with the methylmercury fish tissue objectives shall be determined by analysis of fish tissue as described in Chapter V, Surveillance and Monitoring.

Revise Chapter IV (Implementation) to add:

Cache Creek Watershed Mercury:
The Cache Creek watershed methylmercury and total mercury reduction implementation plan applies to Cache Creek (from Clear Lake to the Settling Basin outflow and North Fork Cache Creek from Indian Valley Reservoir Dam to the main stem Cache Creek), Bear Creek, Sulphur Creek, and Harley Gulch.

Historic mining activities in the Cache Creek watershed have discharged and continue to discharge large volumes of inorganic mercury (termed total mercury) to creeks in the watershed. Much of the mercury discharged from the mines is now distributed in the creek channels and floodplain downstream from the mines. Natural erosion processes can be expected to slowly move the mercury downstream out of the watershed over the next several hundred years. However, current and proposed activities in and around the creek channel can enhance mobilization of this mercury. Activities in upland areas, such as road maintenance and grazing and timber activities can add to the mercury loads reaching Cache Creek, particularly when the activities take place in areas that have elevated mercury levels.

Total mercury in the creeks is converted to methylmercury by bacteria in the sediment. The concentration of methylmercury in fish tissue is directly related to the concentration of methylmercury in the water. The concentration of methylmercury in the water column is controlled in part by the concentration of total mercury in the sediment and the rate at which the total mercury is converted to methylmercury. The rate at which total mercury is converted to methylmercury is variable from site to site, with some sites (i.e., wetlands and marshes) having greatly enhanced rates of methylation.

Since methylmercury in the water column is directly related to mercury levels in fish, the following methylmercury load allocations are assigned to tributaries and the main stem of Cache Creek.

Methylmercury Load Allocations

Tables IV-7 and 8 provide methylmercury load allocations for Cache Creek, its tributaries, and instream methylmercury production. Allocations are expressed as a percent of existing methylmercury loads. The methylmercury allocations will be achieved by reducing the annual average aqueous methylmercury (unfiltered) concentrations to 0.14 ng/L in Cache Creek, 0.06 ng/L in Bear Creek, and 0.09 ng/L in Harley Gulch. The allocations in Tables IV-7 and IV-8 apply to sources of methylmercury entering each tributary or stream segment. In aggregate, the sources to each tributary or stream segment shall have reductions of methylmercury loads as shown below.

Table IV-7
Cache Creek Methylmercury Allocations

Source	Existing Annual Load (gm/yr)	Acceptable Annual Load (gm/yr)	Allocation (% of existing load)
Cache Creek (Clear Lake to North Fork confluence)	36.8	11	30%
North Fork Cache Creek	12.4	12.4	100%
Harley Gulch	1.0	0.04	4%
Davis Creek	1.3	0.7	50%
Bear Creek @ Highway 20	21.1	3	15%
Within channel production and ungauged tributaries	49.5	32	65%
Margin of Safety		7	10% (a)
Cache Creek @ Yolo (b)	122	66	54%
Cache Creek Settling Basin Outflow	87	12	14%

a. Margin of safety is 10% of acceptable loads.
b. Includes 49.6 g/yr exported in agricultural diversions. Cache Creek at Yolo is the compliance point for the tributaries and Cache Creek channel.

Table IV-8 provides the load allocation within Bear Creek and its tributaries to attain the allocation for Bear Creek described in Table IV-7. The inactive mines listed in Table IV-10 are assigned a 95% total mercury load reduction. Reductions in mercury loads from mines, erosion, and other sources in the Sulphur Creek watershed are expected to reduce in channel production of methylmercury to meet the Sulphur Creek methylmercury allocation.

Table IV-8
Bear Creek Methylmercury Allocations

Source	Existing Annual Load (gm/yr)	Acceptable Annual Load (gm/yr)	Allocation (% of existing load)
Bear Creek @ Bear Valley Road	1.7	0.9	50%
Sulphur Creek	8	0.8	10%
In channel production and ungauged tributaries	11.4	1	10%
Margin of Safety		0.3	10% (a)
Bear Creek at Hwy 20	21.1	3	15%

a. Margin of safety is 10% of acceptable loads.

To achieve the water quality objectives and the methylmercury allocations listed in Tables IV-7 and IV-8, the following actions are needed: 1) reduce loads of total mercury from inactive mine sites, 2) where feasible, implement projects to reduce total mercury inputs from existing mercury enriched sediment deposits in creek channels and creek banks downstream from historic mine discharges, 3) reduce erosion of soils with elevated total mercury concentrations, 4) limit activities in the watershed that will increase methylmercury discharges to the creeks and, where feasible, reduce discharges of methylmercury from existing sources, and 5) evaluate other remediation actions that are not directly linked to activities of a discharger. Reducing sediment concentrations of total mercury is expected to reduce methylmercury production. Methylmercury allocations will be achieved in part by natural erosion processes that remove mercury that has deposited in creek beds and banks since the start of mining.

Table IV-9 summarizes implementation projects, affected watersheds, and agencies or persons assigned primary responsibility for mercury load reduction activities, and required completion dates for the projects.

Table IV-9 Implementation Summary

Implementation Project	**Affected Watersheds**	**Assigned Responsibility**	**Action**	**Completion Date**
Inactive Mines	Bear Creek, Harley Gulch, Sulphur Creek	Mine Owners, USBLM	Remediate mines, sediment, and wetlands	2011
Creek Sediments- Harley Gulch Delta Remediation	Harley Gulch	USBLM	Conduct additional studies Submit report on engineering options Conduct projects, as required	2006 2008 2011
Creek Sediments- Upper Watershed	Bear Creek, Davis Creek, Harley Gulch, Sulphur Creek, and Cache Creek (Harley Gulch to Camp Haswell)	USBLM, SLC, CDFG, Colusa, Lake, and Yolo Counties, private landowners	Conduct additional studies Feasibility studies Conduct Projects (as required)	2006 2009 2010
Erosion Control- Upper Watershed	Sub-watersheds with enriched mercury (>0.4 mg/kg, fine grain). Includes areas of Bear Creek, Sulphur Creek, and Cache Creek (Harley Gulch to Camp Haswell)	USBLM, SLC, CDFG, Colusa, Lake, and Yolo Counties, private landowners	Conduct additional studies Identify activities that increase erosion Submit erosion control plans, as required Implement erosion control plans, as required	2006 2007 2009 2011
Erosion Control from New Projects, 10-yr Floodplains	Cache Creek (Harley Gulch to Settling Basin), Bear and Sulphur Creeks, Harley Gulch	Yolo County, Reclamation Board, private landowners, US Army Corps of Engineers	Implement management practices and monitoring for erosion control	During and after project construction
New Reservoirs, Ponds, and Wetlands	Cache Creek watershed	Yolo County or project proponents	Submit plans to control methylmercury discharges	Prior to project construction
Anderson Marsh	Cache Creek at Clear Lake	California State Parks	Conduct additional studies Submit report on management options Conduct Project (as required)	2006 2008 2011

Inactive Mines

Within two years of the date of approval of this amendment, the Regional Water Board shall adopt cleanup and abatement orders or take other appropriate actions to control discharges from the inactive mines (Table IV-10) in the Cache Creek watershed. Responsible parties shall develop and submit for Executive Officer approval plans to reduce loads of mercury from mining or other anthropogenic activities by 95% of existing loads. The responsible parties shall be deemed in compliance with these requirements if remedial actions and maintenance activities are conducted in accordance with the approved plans. Remediation actions at the mines shall be completed by 2011.

Table IV-10
Cache Creek Watershed Inactive Mines (a)

Abbott and Turkey Run Mines
Rathburn and Rathburn-Petray Mines
Petray North and South Mines
Wide Awake Mine
Central, Cherry Hill, Empire, Manzanita, and West End Mines
Elgin Mine
Clyde Mine

(a) The mines are grouped by current landowner. Although remediation requirements apply to each mine site, a single owner or responsible party having adjacent sites may apply the 95% reduction to the total discharge from their sites.

The wetland immediately downstream from the Abbott and Turkey Run mines in Harley Gulch contains mercury and is a source of methylmercury. After mine remediation has been initiated, the responsible parties and owners of the wetland shall develop and submit a remedial plan to reduce the wetland's methylmercury loads to meet the Harley Gulch aqueous methylmercury allocation. The wetland remediation shall be completed by 2011. Remediation at the wetland should not be implemented prior to remediation actions at the upstream mines.

The Sulphur Creek streambed and flood plain directly below the Central, Cherry Hill, Empire, Manzanita, West End and Wide Awake Mines contains mine waste. As part of mine cleanup activities, the responsible parties shall reduce anthropogenic mercury loading in the creek by 85% of existing loads. Mercury and methylmercury loads produced by interaction of thermal springs with mine wastes from the Turkey Run and Elgin mines shall be considered to be anthropogenic loading.

Creek Sediment – Upper Watershed

There are areas downstream from mines in Harley Gulch, Bear Creek, Sulfur Creek, Davis Creek and Cache Creek that have significant deposits of sediment with elevated levels of mercury that were derived, at least in part, from historic discharges from the mines. Where feasible, sediment discharges from these deposits need to be reduced or eliminated.

The Regional Water Board and the USBLM will conduct additional studies to determine the extent of mercury in sediment at the confluence of Harley Gulch and Cache Creek. The Regional Water Board will require the USBLM to evaluate engineering options to reduce erosion of this material to Cache Creek. If feasible projects are identified, the Regional Water Board will require USBLM to remediate the sediment.

At other sites, further assessments are needed to determine whether feasibility studies to control sources of mercury and methylmercury should be required from the landowners. Staff will complete the assessments within one year of adoption of this amendment and feasibility studies will be required from responsible parties, where applicable. Feasibility studies will be required to be submitted no later than four years from approval of this amendment and decisions about implementing remediation actions will be made by the Regional Water Board as part of the five year Basin Plan review cycle. Responsible parties that could be affected by this requirement include the US Bureau of Land Management (USBLM); State Lands Commission (SLC), California Department of Fish and Game (CDFG); Yolo, Lake, and Colusa Counties and private landowners. These requirements apply to stream beds and banks in the following areas: Cache Creek from Harley Gulch to Camp Haswell, Harley Gulch, Sulphur Creek, and Bear Creek south of the Bear Valley Road crossing.

Erosion Control – Upper Watershed

Activities in upland parts of the watershed (i.e., outside the active floodplain), such as road construction and maintenance, grazing, timber management and other activities, can result in increased erosion and transport of mercury to the creeks, especially in parts of the watershed where the soils have elevated levels of mercury. Enriched soil and sediment is defined as having an average concentration of mercury of 0.4 mg/kg, dry weight, in the silt/clay fraction. Provisions described below are applicable in the following areas: the Cache Creek watershed (Harley Gulch to Camp Haswell), Harley Gulch and Sulphur Creek watersheds, and the Bear Creek watershed south of the Bear Valley Road crossing.

Road Construction and Maintenance

Management practices shall be implemented to control erosion from road construction and maintenance activities in parts of the watershed where the soils have enriched levels of mercury. All California Department of Transportation (Caltrans) road construction projects or maintenance activities that result in soil disturbance shall comply with the Caltrans statewide Storm Water Management Plan and implement best management practices to control erosion, including pre-project assessments to identify areas with enriched mercury and descriptions of additional management practices that will be implemented in these areas. Water quality and sediment monitoring may be required to ensure compliance with these requirements. For paved roads, county and agency road departments shall implement the Caltrans or equivalent management practices to comply with these requirements. For unpaved roads, county and agency road departments shall implement all reasonable management practices to control erosion during construction and maintenance activities. Within two years of approval of this amendment, county and agency road departments shall submit information describing the management practices that will be implemented to control erosion from areas with enriched mercury.

Other Activities

A goal of the Regional Water Board is to minimize erosion from areas with enriched mercury concentrations. Further studies are needed to identify specific upland sites within the watershed areas described above that have enriched mercury concentrations and to evaluate whether activities at these sites could result in increased erosion (i.e., grazing, timber harvest activities, etc.). Staff will identify areas with enriched mercury concentrations within one year of adoption of this amendment. After the studies are complete, the Executive Officer will require affected landowners and/or land managers to submit reports that identify anthropogenic activities on their lands that could result in increased erosion. As necessary, erosion control plans will be required no later than four years from adoption of this amendment. Entities responsible for controlling erosion include the US Bureau of Land Management (USBLM); State Lands Commission (SLC), California Department of Fish and Game (CDFG); Yolo, Lake, and Colusa Counties and private landowners.

Landowners implementing new projects or proposing a land-use change on land in the enriched areas shall implement practices to control erosion and minimize discharges of mercury and methylmercury. If the dischargers are not implementing management practices to control erosion or methylmercury discharges, the Regional Water Board may consider individual prohibitions of waste discharge. For proposed changes in land use or new projects, landowners shall submit a plan including erosion estimates from the new project, erosion control practices, and, if a net increase in erosion is expected to occur, a remediation plan.

Erosion Control from New Projects – 10-Year Floodplains

The following requirements for erosion control are for all new projects conducted within the 10-year floodplains of Cache Creek (from Harley Gulch to the Settling Basin outflow), Bear Creek (from tributaries draining Petray and Rathburn Mines to Cache Creek), Sulphur Creek, and Harley Gulch.

Sediment and soil in the depositional zone of creeks downstream of mines in the Cache Creek watershed is enriched in mercury. Erosion of the enriched sediment and soil due to controllable factors needs to be minimized to protect beneficial uses in Cache Creek and to reduce loads of mercury moving downstream to the Settling Basin and the Delta. Compliance with this requirement will be evaluated by comparing monitoring results to the existing Basin Plan turbidity objective that limits incremental increases of turbidity associated with projects.

Project proponents are required to: 1) implement management practices to control erosion, 2) conduct monitoring programs that evaluate compliance with the turbidity objective, and submit monitoring results to the Regional Water Board. The monitoring program must include monitoring during the next wet season in which the project sites are inundated. In general, there must be monitoring for each project. However, in cases where projects are being implemented as part of a detailed resource management plan that includes erosion control practices, monitoring does not need to be conducted for individual projects. Instead, the lead agency may conduct monitoring at designated sites up and downstream of the entire management plan area.

Upon written request by project proponents, the Executive Officer may waive the turbidity monitoring requirements for a project, or group of projects, conducted under a management plan if the project proponents submit information that clearly demonstrates that the project will not result in a net increase in erosion.

Whenever practicable, proponents should maximize removal of mercury enriched sediment from the floodplain. Sediment removed from the channel or the Settling Basin must be placed outside of the floodplain so that it will not erode into the creek. For projects related to habitat restoration or erosion control consistent with a comprehensive resource management plan, the lead agency may relocate sediment within the channel if the lead agency uses the sediment to enhance habitat and provides appropriate erosion controls.

Some projects may not be able to meet the turbidity objectives even when all reasonable management practices will be implemented to control erosion. These projects may still be implemented if project proponents implement actions (offset projects) in some other part of the watershed that would reduce or otherwise prevent discharges of sediment containing mercury in an amount at least equivalent to the incremental increases expected from the original project. Removal of sediment from the Settling Basin would be an acceptable offset project.

All bridge, culvert, or road construction or maintenance that may cause erosion within the 10-year flood plains must follow the Caltrans management practices or equivalent to control erosion, as described above.

New Reservoirs, Ponds, and Wetlands

Reservoirs, ponds, impoundments and wetlands generally produce more methylmercury than streams or rivers. Building new impoundments and wetlands that discharge to creeks in the Cache Creek watershed can add to the existing loads of methylmercury in Cache Creek and its tributaries. New impoundments, including reservoirs and ponds, and constructed wetlands shall be constructed and operated in a manner that would preclude an increase in methylmercury concentrations in Cache Creek, Bear Creek, Harley Gulch, or Sulphur Creek. This requirement applies to all new projects in the watershed, including gravel mining pits in lower Cache Creek that are being reclaimed as ponds and wetlands, for which physical construction is started after the approval of this amendment. "Preclude an increase in methylmercury concentrations" shall be defined as a measurable increase in aqueous concentration of methylmercury downstream of the discharge relative to upstream of the discharge.

Any entity creating an impoundment or constructed wetland that has the potential through its design to discharge surface water to Cache Creek Bear Creek, Harley Gulch, or Sulphur Creek (uncontrollable discharge after inundation by winter storm flows is excepted) must submit plans to the Regional Water Board that describe design and management practices that will be implemented to limit the concentration of methylmercury in discharges to the creek.

The Executive Officer will consider granting exceptions to the no net increase requirement in methylmercury concentration if: 1) dischargers provide information that demonstrates that all reasonable management practices to limit discharge concentrations of methylmercury are being implemented and 2) the projects are being developed for the primary purpose of enhancing fish and wildlife beneficial uses. In granting exceptions to the no net increase requirement, the Executive Officer will consider the merits of the project and whether to require the discharger to propose other activities in the watershed that could offset the incremental increases in methylmercury concentration in the creek. The Regional Water Board will periodically review the progress towards achieving the objectives and may consider prohibitions of methylmercury discharge if the plan described above is ineffective.

The Cache Creek Nature Preserve (CCNP), which includes a wetland restored from a gravel excavation, currently minimizes any methylmercury discharges to Cache Creek by holding water within the wetlands. If water management in the CCNP wetlands is changed significantly, the operator must submit plans describing management practices that will be implemented to limit methylmercury discharge to Cache Creek.

Anderson Marsh Methylmercury

The Regional Water Board, in coordination with California State Parks (CSP), will continue to conduct methylmercury studies in Anderson Marsh. If the Regional Water Board finds that Anderson Marsh is a significant methylmercury source to Cache Creek, the Regional Water Board will require CSP to evaluate potential management practices to reduce methylmercury loads. The Regional Water Board will then consider whether to require CSP to implement a load reduction project.

Cache Creek Settling Basin

Although the Cache Creek settling basin retains about one half of the total mercury attached to sediment that enters the basin, there is a net increase in methylmercury discharged from the settling basin. Methylmercury loads are expected to decrease as inflow mercury concentrations decline. The Regional Water Board will continue to conduct methylmercury studies in the basin and work with the Reclamation Board and the US Army Corps of Engineers to develop settling basin improvements to retain more sediment and reduce methylmercury loads. The Sacramento-San Joaquin Delta mercury reduction implementation plan will include methylmercury load reduction requirements for the settling basin.

Geothermal and Spring Sources

In general, geothermal springs that discharge mercury and sulfate may not be controllable. However, geothermal discharges adjacent to Sulphur Creek are potential candidates for remediation or mercury offset projects. As needed, the Executive Officer will make a determination of the suitability of geothermal source controls for offset or remediation projects.

Thermal springs used by the Wilbur Hot Springs resort are a source of mercury and methylmercury to Sulphur Creek. Discharges of mercury or methylmercury from springs used or developed by the Wilbur Hot Springs resort shall not exceed current loads.

Potential Actions

This control plan focuses on reducing mercury discharges from mercury mines, controlling activities that mobilize past discharges from the mines, controlling activities that enhance methylation of mercury, and implementing remediation activities at sites where sediment rich in mercury has accumulated. Responsibility for these actions may be assigned to responsible parties. There are a number of other actions that may be considered that would reduce loads of mercury in the creek that are not directly the responsibility of a discharger. The following actions are recommended for further evaluation:

- Construction of a settling basin upstream of Rumsey. The facility could trap mercury enriched sediment, reduce downstream loads and preserve space in the existing settling basin in Yolo Bypass.
- Methylmercury reduction plans for Bear Creek
- Load reductions from Davis Creek

Mercury Offset Program and Alternative Load Allocations

The Regional Water Board recognizes that remediation of mines and non-point sources will require substantial financial resources. The Regional Water Board, therefore, will allow entities participating in approved mercury offset programs to conduct offset remediation projects in the Cache Creek watershed. Offset programs shall be focused on projects where funding is not otherwise available. Subject to approval by the Executive Officer, entities participating in an offset program may partner with agencies in mercury control actions. The framework for offset programs will be developed in future Basin Plan amendments.

The methylmercury load allocations in Tables IV-7 and 8 are assigned to watersheds. To allow offset program proponents to conduct projects within the watersheds to reduce loads, the Regional Water Board may consider alternative load allocations that will achieve the objectives.

Public Education

The local county health departments should provide outreach and education regarding the risks of consuming fish containing mercury, emphasizing portions of the population that are at risk, such as pregnant women and children.

Adaptive Implementation

The Regional Water Board will review the progress toward meeting the water quality objectives and the Basin Plan requirements at least every five years. The Regional Water Board recognizes that it may take hundreds of years to achieve the fish tissue objectives. Entities are in compliance if they follow the above requirements and approved plans for mercury, methylmercury, and erosion controls. The Regional Water Board considers entities to be in compliance with this mercury reduction plan if they follow the above requirements for mercury, methylmercury, and erosion controls. The Regional Water Board recognizes that there are uncertainties with the load estimates and the correlation between reductions in loads of total mercury, methylmercury uptake by biota, and fish tissue concentrations. Using an adaptive management approach, however, the Regional Water Board will evaluate new data and scientific information to determine the most effective control program and allocations to reduce methylmercury and total mercury sources in the watershed.

Monitoring and Review

The monitoring plan for Cache Creek is described in Chapter V, Surveillance and Monitoring. Regional Water Board staff will oversee the preparation of detailed monitoring plans and resources to conduct monitoring of sediment, water, and fish to assess progress toward meeting the water quality objectives. Regional Water Board staff will take the lead in determining compliance with fish tissue objectives for Cache Creek. Monitoring at mine cleanup sites or monitoring for compliance with the proposed erosion control requirements is the responsibility of the project proponents.

Revise Chapter IV (Surveillance and Monitoring) to add:

~~**Clear Lake Methylmercury**~~

~~The Regional Water Board will use the following criteria to determine compliance with the methylmercury fish tissue objectives in Clear Lake. Mercury will be measured in fish of the species and sizes consumed by humans and wildlife. The objectives are based on the average of methylmercury concentrations in muscle tissue of trophic level 3 and 4 fish. Because greater than 85% of total mercury in muscle tissue of fish of these sizes is methylmercury, analysis of muscle tissue for total mercury is acceptable for assessing compliance.~~
~~Fish from the following species will be collected and analyzed every ten years. The representative fish species for trophic level 4 shall be largemouth bass (total length 300-400 mm), catfish (total length 300 – 400 mm), brown bullhead (total length 300-400 mm), and crappie (total length 200-300 mm). The representative fish species for trophic level 3 shall be carp, hitch, Sacramento blackfish, black bullhead, and bluegill of all sizes; and brown bullhead and catfish of lengths less than the trophic level 4 lengths.~~

~~Fish tissue mercury concentrations are not expected to respond quickly to remediation activities at Sulphur Bank Mercury Mine, Clear Lake sediments, or the tributaries. Adult fish integrate methylmercury over a lifetime and load reduction efforts are not expected to be discernable for more than five years after remediation efforts. Therefore to assess remedial activities, part of the monitoring at Clear Lake will include indicator species, consisting of inland silversides and largemouth bass less than one year old, to be sampled every five years.~~

~~Juveniles of these species will reflect recent exposure to methylmercury and can be indicators of mercury reduction efforts.~~

~~Average concentrations of methylmercury by trophic level should be determined in a combination of the identified species collected throughout Clear Lake. The number of fish collected to determine compliance with this objective will be based on the statistical variance within each species. The sample size will be determined by methods described in USEPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish or other statistical methods approved by the Executive Officer.~~

~~Total mercury in tributary sediment, lake sediment, and water will be monitored to determine whether loads have decreased. The water and sediment monitoring frequency will be every five years.~~

Mercury and Methylmercury

The Regional Water Board will use the following criteria to determine compliance with the methylmercury fish tissue objectives. Site-specific criteria for various water bodies are described below.

In general, the objectives are based on the average of methylmercury concentrations in muscle tissue of trophic level (TL) 3 and 4 fish as appropriate. Because greater than 85% of total mercury in muscle tissue of fish of these sizes is methylmercury, analysis of muscle tissue for total mercury is acceptable for assessing compliance. Mercury will be measured in fish of the species and sizes consumed by humans and wildlife.

The number of fish collected to determine compliance with the methylmercury objective will be based on the statistical variance within each species. The sample size will be determined by methods described in USEPA's Guidance for Assessing Chemical Contaminant Data for Use in Fish or other statistical methods approved by the Executive Officer.

Compliance with the fish tissue objective is achieved when the average concentrations in local fish are equivalent to the respective objective for three consecutive years.

Clear Lake

Fish from the following species will be collected and analyzed every ten years. The representative fish species for trophic level 4 shall be largemouth bass (total length 300-400 mm), catfish (total length 300 – 400 mm), brown bullhead (total length 300-400 mm), and crappie (total length 200-300 mm). The representative fish species for trophic level 3 shall be carp, hitch, Sacramento blackfish, black bullhead, and bluegill of all sizes; and brown bullhead and catfish of lengths less than the trophic level 4 lengths.

Fish tissue mercury concentrations are not expected to respond quickly to remediation activities at Sulphur Bank Mercury Mine, Clear Lake sediments, or the tributaries. Adult fish integrate methylmercury over a lifetime and load reduction efforts are not expected to be discernable for more than five years after remediation efforts. To assess remedial activities, part of the monitoring at Clear Lake will include indicator species, consisting of inland silversides and largemouth bass less than one year old, to be sampled every five years. Juveniles of these species will reflect recent exposure to methylmercury and can be indicators of mercury reduction efforts.

Average concentrations of methylmercury by trophic level should be determined in a combination of the identified species collected throughout Clear Lake.

Total mercury in tributary sediment, lake sediment, and water will be monitored to determine whether loads have decreased. The water and sediment monitoring frequency will be every five years

Cache Creek, Bear Creek, and Harley Gulch

The Regional Water Board will use the following criteria to determine compliance with the methylmercury fish tissue objectives in Cache and Bear Creeks. Compliance with the respective objectives shall be determined based on fish tissue analysis in Cache Creek from Clear Lake to the Settling Basin, North Fork Cache Creek, and Bear Creek upstream and downstream of Sulphur Creek.

The representative fish species for each trophic level shall be:

- Trophic Level 3: green sunfish, bluegill, and/or Sacramento sucker (rainbow trout also an option for North Fork Cache Creek);
- Trophic Level 4: Sacramento pikeminnow, largemouth bass, smallmouth bass and/or channel catfish.

The sample sets should include at least two species from each trophic level (i.e., bass and Sacramento pikeminnow, for TL4) collected at each compliance point or stream section. The samples should include a range of sizes of fish between 250 and 350 mm, total length, averaging 300 mm. If green sunfish and bluegill are not available in this size range; those sampled should be greater than 125 mm total length. If two species per trophic level are not available and are unlikely to be present given historical sampling information, one species is acceptable (the only TL4 species typically in North Fork is Sacramento pikeminnow).

Compliance with the Harley Gulch methylmercury water quality objective will be determined using hardhead, California roach, or other small (TL2/3), resident species in the size range of 75-100 mm total length.

Aqueous methylmercury goals are in the form of the annual average concentration in unfiltered samples. For comparison of methylmercury concentration data with aqueous methylmercury goals, water samples should be collected periodically throughout the year. The samples should be collected during typical flow conditions as they vary by season, rather than targeting extreme low or high flow events. Aqueous methylmercury data may be collected by Regional Water Board staff or required of project proponents.

Monitoring for mine and remediation projects or other activities that are expected to significantly affect methylmercury or mercury loads should include:

- Monitoring parameters for soil and sediment should be total mercury in soil or sediment, silt/clay (<63 microns) fraction.
- Monitoring parameters for water should include: methylmercury (if project is methylmercury source), total mercury, total suspended solids, turbidity, and stream flow. Water sampling in major tributaries must include high flow events for mercury and total suspended solids. More frequent monitoring (two to four significant storm events for three consecutive years) is required post remediation to evaluate the effectiveness of cleanup projects and compliance with load allocations.

Appendix J
Summary of Cost Estimates for Implementation Alternatives for Control of Mercury in the Cache Creek Watershed[1]

Table L.1 Summary of Costs Estimates for Implementation Alternatives		
Alternative 2 Implementation		
	Capital	O&M, per year
Inactive Mine Remediation (Includes Sulphur Creek stream bed directly below lower mines and Harley Gulch wetland.	$10,837,740	$425,520
Creek Sediments - Harley Gulch	$1,158,450	$115,850
Creek Sediments - Upper watershed (For Alt 2, includes 1 project in addition to Harley Gulch Delta)	$1,200,000	$120,000
Erosion control - upper watershed	$200,000	$20,000
Methylmercury inputs from new projects (O&M = monitoring and reporting), per project	$13,700	$1,700
Anderson Marsh (project and therefore costs unknown. Based on likely estimate of worth of project to reduce MeHg, relative to costs of other measures in watershed. O&M is 10% of initial project, per year)	$200,000	$20,000
Erosion control in 10-Yr Floodplain d/s mines (assume do projects beyond 2035 (30)	$12,400	$5,000
Public Outreach and Education	$15,000	$2,500
RB sampling (*)	$53,230	$2,010
Total	$13,690,520	$712,580
(rounded for Table 5.5)	$14,000,000	$700,000
* Initial RB sampling is cost of water and soil/sediment sampling in upper watershed. Assume test compliance with fish tissue objectives 4 times every 100 years; annual O&M shown as if paid fish sampling costs per year.		
Additional Projects for Alternative 3		
Thermal springs	$671,754	$829,100
Selected creek sediments (10 more projects)	$12,000,000	$1,200,000
Anderson Marsh (additional measures to reduce methylmercury export)	$1,000,000	$10,000
Additional erosion control in upper watershed (implementation, inspection, waste discharge reports)	$1,500,000	$150,000
Sediment retention basins	$40,000,000	$1,000,000
add Alt 2 costs	$13,762,887	$710,567
total	$68,934,641	$3,899,667
rounded for Table 5.5	$70,000,000	$4,000,000

[1] Details of cost estimates are on following pages.

Alt 2 and 3: Mine Remediation

Source: Tetra Tech, 2004. Engineering Evaluation and Cost Analysis for Sulphur Creek Mining District, Prepared for CALFED, Task 5C Final Report

	Capital Cost	Yearly O&M	cost estimate source
Abbott	$4,249,215	$52,924	recommended final mitigation strategy, TT Table 9-10
Turkey Run	$551,397	$34,543	recommended final mitigation strategy, Table 9-10
Cherry Hill	$81,689	$9,444	recommended final mitigation strategy, Table 9-10
West End	$165,266	$17,659	recommended final mitigation strategy, Table 9-10
Manzanita	$160,442	$15,951	recommended final mitigation strategy, Table 9-10
Elgin	$389,364	$18,443	recommended final mitigation strategy, Table 9-10
Rathburn-Petray	$2,446,448	$37,092	recommended final mitigation strategy, Table 9-10
Petray North	$284,974	$22,876	recommended final mitigation strategy, Table 9-10
Sulphur Ck streambed	$897,034	$82,802	recommended interim mitigation strategy, Table 9-10
Wide Awake	$545,282	$37,944	recommended final mitigation strategy, Table 9-10
Empire	$13,356	$1,843	recommended final mitigation strategy, Table 9-10
Central	$135,089	$13,111	recommended final mitigation strategy, Table 9-10
Clyde	$97,612	$10,412	TT Alt. 3 Strategy, (grading and revegetation), Table 8-2.
Rathburn	$180,076	$14,980	recommended final mitigation strategy, Table 9-10
Petray South	$51,493	$8,373	recommended final mitigation strategy, Table 9-10
HG wetland	$589,000	$47,120	See H. Gulch spreadsheet, based on TT, NRCS, & Penn Mine
Totals	$10,837,737	$425,517	

Notes: Cost estimates include indirect (includes engineering plan, environmental review, insurance, contingency, and project management) and direct project costs, in 2003 dollars. Tetra Tech EM, Inc. developed cost estimates using RACER (Remedial Action Cost Engineering and Requirements) software.

Harley Gulch wetland estimate is described on the Harley Gulch spreadsheet. The Harley Gulch wetland was not included in the Tetra Tech EE/CA report. Recommended mitigation strategies for Turkey Run and Elgin mines do not include treatment or rerouting of springs assumed to currently pass through adits. Some additional mitigation of springs may be needed to prevent leachate from reaching creeks. Tetra Tech's recommended mitigation strategies for Rathburn and Petray-South mine sites acknowledge thermal water below the sites, but assume that none reaches Bear Creek. Staffs of the Regional Board and USGS are planning additional studies of sources of mercury to Bear Creek, including springs in the mine areas. Recent data indicate that mercury in spring water reaches Bear Creek, but whether the spring water is interacting with mine waste is not yet known.

In performing the engineering evaluations, Tetra Tech considered the following:

- surface and institutional controls (surface water diversion and fencing),
- type of solid waste containment (soil covers or fully encapsulated waste management units),
- excavation and waste consolidation (disposal on or off-site),

- remediation of mine structures (solids removal around buildings and either leave historic buildings or demolition),
- stream sediment (excavate and on- or off-site disposal, or revegetation and stream bank stabilization),
- surface and geothermal water treatment (e.g., diversion, chemical precipitation, aeration, in-stream and off-stream reactors).

Alt 2 and 3: Harley Gulch Wetlands

3.5 Acres = 17,000 - 34,000 yds^3		
Dispose of sediment in Group B repository on Abbott Mine site		
		170 days to haul 34,000 yards
One truck can haul ~ 200 yards/day		170 x $1500/day = $255,000
Assume 4 trucks and 2 backhoes; (43 days to haul)		
Preproject planning, review, management	$100,000	
Transport and Disposal	$255,000	170 x $1500/day
Backhoe	$68,800	2 x 43 x $800/day
Backfill	$255,000	
Grading	$40,000	
Revegetate	$7,000	Assume $2,000/acre for native planting (NRCS Electronic Field Office Training Guide Costs Estimates for Projects 2005)

Total Capital	$725,800	
Total O&M per year	$58,064	(Assume 8% of capital costs, based on estimate from similar surface controls and revegetation in Tetra Tech EE/CA, Alt 3 options).

Alt 2 and 3: Remediate Harley Gulch Delta

1.5 acres x 6.5 ft (2 meters) deep

Cubic yards: 15,870

Assume $35/cu yard for sediment removal and disposal. Can utilize Group B repository at Abbott Mine site or dispose elsewhere. (Experience of Penn Mine was $25/cu yard for removal; assume is greater for this project for disposal).

Project could include sediment stabilization instead of removal. Costs difficult to estimate, as feasibility study has not been performed.

Indirect (preproject planning, oversight)	$100,000	
trail construction/airlift equipment	$500,000	(best judgment estimate)
sediment removal, disposal	$555,450	($35/cu yard x 15870 yd)
Restoration	$3,000	(NRCS estimate $2,000/acre for critical area planting
total	$1,158,450	
Total O&M, per year	$115,845.0	

(Assume 10%, as for similar surface projects in Tetra Tech EE/CA)

Alt 2 & 3. Remediation of Selected Sediments with Elevated Levels of Hg

Alt 2: Assume conduct 2 projects, including Harley Delta.
Double the Harley Gulch Delta costs
Note: Other sites considered feasible, such as sediment in Sulphur Creek at confluence with Bear Creek, will likely not be as difficult in terms of transport of sediment. Sulphur Creek at Bear Creek is much more accessible. Sediment in Cache Creek bars directly down stream of Davis Creek is distant from highway, but accessible by road.

Harley Gulch delta estimate is approximately:	$1,200,000
Double estimate for capital costs	$2,400,000
O& M, per year (10% of capital)	$240,000

Alt 3: Assume conduct 5 or more projects equal to Harley Gulch Delta in cost

	Capital	O&M per year
5 projects:	$6,000,000	$600,000
10 projects	$12,000,000	$1,200,000
3 projects	$3,600,000	

Alt 2. Erosion Control, Upper Watershed: Management on upland enriched areas
Assume this is "low effort" cost.

Assume 10 landowners are affected	Unit cost	Initial
Landowner prepare and submit report on land use and erosion control practices	$2000 per landowner/consultant time to prepare report	$20,000

Assume total area identified as having soils enriched in mercury is at maximum 20,000 acres. (This is twice the total of Sulphur Creek and Harley Gulch watershed areas). Most of land in Cache Creek watershed is undeveloped. Currently, no grazing or timber harvest occurs on USBLM property. Assume land use practices that potentially cause erosion occur on 25% of property, or 5,000 acres (for comparison, the sub-watershed of West Fork Harley Gulch, where mines are located, is less than 25% of acreage of total Harley Gulch watershed). Costs of possible management practices to minimize erosion from these lands are shown below. Practices and cost estimates per unit are from:
USDA Natural Resources Conservation Service, 2005. Customer Service Toolkit Cost List Database

Component	Unit Type	Unit Cost	
Conservation Cover	acre	$150	
Filter Strip	acre	$100	
Prescribed Grazing, Woodland/Forestland	acre	$10	
Range Planting, Native Species	acre	$250	
Road/Landing Removal	acre	$100	
Forest Harvest Trails	acre	$100	
Fence, Conventional	foot	$2	
water trough outside of creek, gravity fed from creek	(per item)	$1,000	
Unpaved road maintenance for erosion control	unknown	$50,000	cost unknown. Assume $50,000 to initially implement.

For area of concern of 5,000 acres, costs could range from $50,000 to $1,250,000 to implement. Upper estimate assumes that the most expensive treatment (native planting on rangeland) is needed over the entire area.
Assume 10% of initial cost for maintenance per year.
Added extra $100,000 to Alt 2 estimate, for projects or practices not identified above

Assume $50,000 for initial implementation of management practices on unpaved roads, although this is already a cost that Yolo County is assuming (Yolo Co. has completed first year of implementing erosion control management practices developed by Mendocino County RCD for rural and timber harvest roads. Yolo County decided to implement the road management practices independently of the TMDL. Personal communication from Rick Moore, Yolo Co, 8/2/05. In an email sent on 8/9/05, Mr. Moore estimated that the cost of implementing improved management on roads in the upper watershed area is $12,000.)

Alt 2 total estimate: reports plus low estimate of implementation	$200,000
Alt 3 total estimate: reports plus more extensive implementation, inspections, waste discharge reports	$1,500,000

Alt 2 and 3. Estimate of costs for erosion control requirements in 10-year floodplain

Basin Plan amendment requires management practices to control erosion and turbidity monitoring
Management practices (MPs) should already be implemented; this is a requirement of the Cache Creek Resources Management Plan (covers Cache Creek from Capay to Yolo). MPs will be a requirement of any projects completed under proposed general permit for Lake and Yolo Counties in Cache Creek u/s Capay and will be required of individual application for 404 Permit and 401 Water Quality Cert.
Therefore, MPs costs are not detailed here. New costs associated with the Basin Plan amendment are expenses for turbidity monitoring and reporting. Turbidity objective is already in the Basin Plan, but compliance and reporting are being required in the mercury Basin Plan amendment.
Note that Basin Plan amendment does not require monitoring for mercury in sediment in 10-year floodplain.
10-year floodplains d/s of mined areas are likely enriched in mercury, but the turbidity objective should be attained anywhere.

Item	Initial Cost			Ongoing Cost - Per Year	
	Quantity	unit cost	total cost	Quantity	total cost per year*
Turbidity meter	2 meters and mounts	$3,000	$6,000	replace one meter every 5 years	$600
Staff time	install and maintain meters (up and down stream of project area). 4 days	$100/hour	$3,200	maintain meters, 1 day	$800
Staff time	download data, prepare report. 4 days	$100/hour	$3,200	prepare one report/year, 4 days	$3,200
			$12,400		$4,600

(round for summary table)

* Note that per year cost assumes projects are being conducted each year, which may not be the case

Basin Plan amendment permits monitoring up and downstream of general permit area. Thus, monitoring costs for multiple projects in single permit area may be less expensive than on a per-project basis.

Alt 2 and 3. Limits on Methylmercury Discharge to Creek

If project is proposed that will discharge surface water containing methylmercury to Cache Creek,
the project must not result in increase in concentration of MeHg in Cache Creek.
New cost to the project are: identify design or practices to limit MeHg entering Cache Creek and submit plans to RB, and monitor discharge for MeHg in water.
Costs below are on a per-project basis
Assume Hg monitoring occurs at every discharge.

Item	Initial Cost			Ongoing Cost - Per Year		
	Quantity	Unit Cost	Total Cost		Unit cost	Total Cost per Year
Develop design and/or management plans that limit MeHg to creek, submit to RB	10 days staff/consultant time	$150/hour	$12,000			
MeHg monitoring	Assume discharge 2x/year, monitor upstream, in discharge, and downstream	$150 sample	$900	Assume discharge 2x/year, monitor upstream, in discharge, and downstream	$150 sample	$900
report MeHg results to Regional Board	2 days	$100/hour	$1,600	Prepare data report, 1 day	$100/hour	$800
			$14,500			$1,700

Alt 2 & 3 Anderson Marsh

Basin Plan Amendment calls for additional study of methylmercury discharged from Anderson Marsh to Cache Creek and evaluation of potential management practices to reduce impact of methylmercury produced in the marsh.

Costs of further sampling are included in estimate of RB sampling costs ($38K)
Management practices are unknown; could include aeration, channelization, revegetation, sediment removal, levees, or a combination with other practices. Costs difficult to predict, based on best professional judgment
Assume range of $200,000 (low range, possible for action under Alt 2.) to $1,000,000 (possible under Alt 3)
Based on likely estimate of worth of project to reduce MeHg, relative to costs of other measures in watershed.
O&M is 10% of initial project

Alt 1, 2, and 3. Public Outreach and Education

Based on estimate from Tom To, Yolo Co. Public Health

3 educational/warning signs on Sac River cost $3-4,000.

Yolo Co. (Petrea Marchand) said that County is spending $2000 to post on Cache Creek

Item	Initial Cost			Ongoing Cost - Per Year		
	Quantity	Unit Cost	Total Cost		Unit	Total Cost per Year
signs	8	$1,000	$8,000	replace signs	1	$1,000
educational materials (pamphlets, posters English, Spanish)	Includes development and translation. Estimated from Delta Fish Project costs (DHS, UCDavis & OEHHA)		$3,000	reprint materials		$500
staff time	5 days (initial time to organize and decide on outreach strategy, place signs, prepare materials)	$100/hour	$4,000	Coordinate sign replacement and additional outreach, 1 day	$100/hour	$800
			$15,000			$2,300
				(round for summary table)		$2,500

Alt 2 and 3. Additional Sampling by Regional Board Staff

Sampling estimates are based on present costs for analysis of samples collected by Regional Board. Includes analysis by reputable laboratory with proven ability to analyze methylmercury, QA/QC procedures, and sample vessels.	
Anderson Marsh Sampling	
8 sites per month methylmercury in water for 4 months	
1 x 8 x 4 x $140 =	$4,480
8 sites per month total mercury in water for 4 months	
1 x 8 x 4 x $100 =	$3,200
24 sites 1x for total mercury in sediment	
2 x 12 x $75 =	$1,800
Sum	$9,480
sample #	88
Cache Creek Sampling	
4 sites, methylmercury in water for 6 events	
1 x 4 x 6 x $140 =	$3,168
4 sites, total mercury in water for 6 events	
1 x 4 x 6 x $100 =	$2,400
100 sites for Hg in sediment to examine enriched areas	
100 x $75 =	$7,500
Sum	$13,068
sample #	148
Bear Creek Sampling	
10 sites per month methylmercury in water for 1 year	
1 x 10 x 12 x $140 =	$16,800
10 sites per month total mercury in water for 1 year	
1 x 10 x 12 x $100 =	$12,000
25 sites for mercury in sediment to examine mine loads	
25 x $75 =	$1,875
Sum	$30,675
sample #	265
Total Water and Sediment Sampling Sum	$53,223
total number of samples	501

Alt 1, 2 and 3: Regional Board fish monitoring for compliance with objectives

4 Cache Creek sites; 2 Bear Creek sites. 1 Harley Gulch site.

Cost per analysis of tissue sample:		$150	(current expense of CDFG Moss Landing Lab analysis)
Cost of collection per site		$2,000	(current expense of CDFG Moss Landing Lab collection)
Collect 10 fish per trophic level per site. Cache and Bear sites have 2 trophic levels. Harley has one.			

Estimated frequency of sampling: Sample 4 times in next 100 years (3 single-year efforts to monitor progress and 1 three-year effort, as if testing for compliance)
Note: it is likely that Regional Board would sample soon after mine remediations/implementation of erosion control in upper watershed.
If fish concentrations have declined significantly, may monitor again soon or test for compliance (3-year effort). If fish concentrations have not changed significantly, will likely wait for more passive erosion and/or better science before sampling fish again. The estimates below are likely the most intensive that will occur.

Sampling to occur in one year's effort:

	# Sites	Unit Site Cost	# Analyses	Unit Analysis Cost	Total
Cache Creek	4	$2,000	80	$150	$20,000
Bear Creek	2	$2,000	40	$150	$10,000
Harley Gulch	1	$2,000	10	$150	$3,500
					$33,500

Assume sample total of six years in 100-year period: $201,000
(3 single-year efforts to monitor progress and 1 three-year effort, to test for compliance)
For calculating ongoing cost, take cost of 6 future sampling events divided by 100 years to obtain cost per year of $2,010. Treat as annual O&M.

	Initial	Other sampling in next 100 years
Total Water and Sediment Sampling (from previous table)	$53,230	
Total Fish Sampling in 100 years		$201,000
	$53,230	$201,000

Alt 3: Additional remediation in Sulphur Creek by treating springs

Alt 3 includes treatment of springs in Lower Sulphur Creek streambed to remove metals and sulfur using In-channel flashboard dams, passive zero valence iron reactors, and aeration screens.
O&M is high, because of annual need to remove precipitates, replace reactor components and move dams.
Reference: Tetra Tech, 2004. Table 8-14, Alternative 15 for spring treatment

Capital	O&M per year
$671,754	$829,100

Alt 3: Treatment of Thermal springs

	initial	O&M	reference
Blanck spring	$202,064	$59,261	TT, table 8-11 Alt 12
Elgin spring	$261,483	$52,920	TT, table 8-11 Alt 13
Turkey Run spring	$359,258	$182,916	TT, table 8-11 Alt 14
Total	$822,805	$295,097	

Alt 3: Construction of Sediment Basins below tributaries with Hg-enriched sediment

Assume construct 2 small basins, each less than 10 acres

Unit costs for feasibility study and mitigation are best professional judgment

Unit costs for levee construction and sediment removal from Cache Creek Settling Basin Mercury Study (CDM, 2004).

Item	Initial Cost			Ongoing Cost - Per Year		
	Quantity/ comment	unit cost	total cost		Quantity	total cost per year
feasibility studies	could be difficult to site, require modeling	$1,500,000	$3,000,000			
basin construction	take CCSB est for 1 mile of levee x 8 miles	$4,000,000	$32,000,000			
mitigation	Possibly needed for loss of habitat or cultural feature	$5,000,000	$5,000,000			
				sediment removal and maintenance take CCSB est for 10,000 cubic yards per year per basin	$500,000	$1,000,000
			$40,000,000			$1,000,000